

# AIDS TO FORENSIC MEDICINE



DOUGLAS HENNING

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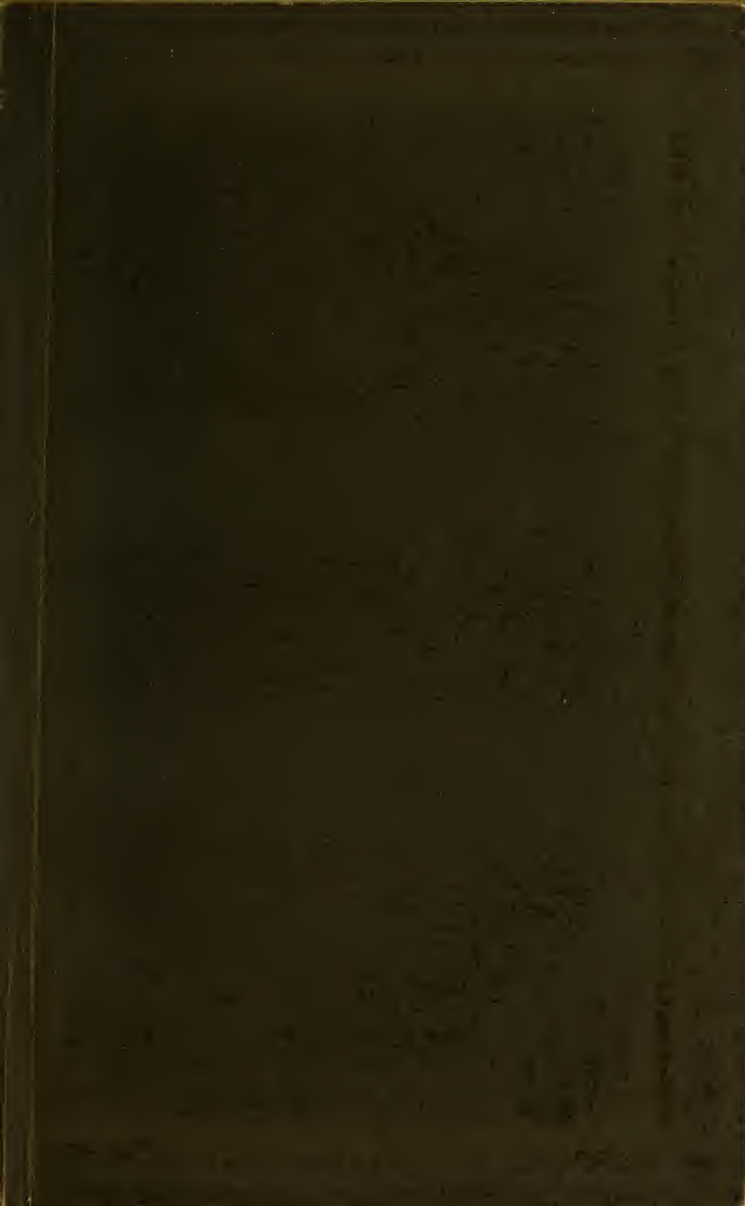
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# AIDS

TO

## FORENSIC MEDICINE

AND

## TOXICOLOGY.

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## PREFACE TO THE SECOND EDITION.

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A SECOND EDITION of this little work having been called for within twelve months, I have taken advantage of the opportunity to carefully revise each page and correct some errors of the first edition, and hope thus to have rendered the book still more worthy of patronage and more useful to the student on the eve of his examinations.

I must here express my warmest thanks to my friend Dr. Aubrey Husband, author of "The Student's Handbook of Forensic Medicine," who has given me many valuable suggestions in the preparation of this edition.

I have also endeavoured to take advantage of the kind hints of reviewers.

W. DOUGLAS HEMMING.

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## PREFACE TO THE FOURTH EDITION.

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IN this edition of the late Mr. Hemming's little book, I have made considerable additions to nearly every page, introducing such information as experience has taught me is most needed by the student.

H. A. H.

# CONTENTS.

PART I.	PAGE	PART I.	PAGE
<b>FORENSIC MEDICINE.</b>		<b>FORENSIC MEDICINE.</b>	
I. Medical Evidence .....	6	VI. Treatment of Poisoning .....	51
II. Personal Identity .....	7	VII. Detection of Poisons .....	52
III. Impotence and Sterility .....	9	VIII. The Mineral Acids .....	55
IV. Rape .....	10	IX. Sulphuric Acid .....	57
V. Pregnancy .....	11	X. Nitric Acid .....	58
VI. Delivery .....	12	XI. Hydrochloric Acid .....	59
VII. Fœticide .....	13	XII. Alkalies .....	59
VIII. Infanticide .....	15	XIII. Potash .....	60
IX. Evidences of Live Birth .....	16	XIV. Soda .....	61
X. Cause of Death in Fœtus .....	20	XV. Ammonia .....	61
XI. Legitimacy .....	20	XVI. Irritants .....	62
XII. Duration of Pregnancy .....	21	XVII. Nitrate, Sulphate, and Bi-	
XIII. Viability of Children .....	22	tartrate of Potash .....	62
XIV. Superfoetation .....	22	XVIII. Alum, Sulphuret of Potas-	
XV. Inheritance .....	23	sium .....	63
XVI. Feigned Diseases .....	23	XIX. Chloride of Sodium .....	63
XVII. Mental Unsoundness .....	24	XX. Chlorides of Lime, Soda, and	
XVIII. Idiocy, Imbecility, Cre-		Potash .....	64
tinism .....	26	XXI. Barium Salts .....	64
XIX. Dementia : Acute, Chronic,		XXII. Irritant Gases .....	65
Senile, and Paralytic .....	27	XXIII. Phosphorus .....	65
XX. Mania .....	28	XXIV. Iodine, and Iodide of Po-	
XXI. Examination of Persons of		tassium .....	66
Unsound Mind .....	30	XXV. Arsenic .....	67
XXII. Examination of Persons		XXVI. Antimony .....	71
Found Dead .....	32	XXVII. Mercury .....	73
XXIII. Modes of Sudden Death...	32	XXVIII. Lead .....	75
XXIV. Signs of Death .....	33	XXIX. Copper .....	76
XXV. Death by Drowning .....	36	XXX. Zinc, Tin, Silver, Iron,	
XXVI. Death by Hanging .....	37	Bismuth, Chrome .....	77
XXVII. Death by Strangulation .	37	XXXI. Narcotics : Opium and	
XXVIII. Death by Suffocation ...	38	Morphia .....	79
XXIX. Wounds and Mechanical		XXXII. Belladonna, Hyoscy-	
Injuries .....	38	amus, Stramonium, and	
XXX. Contused Wounds .....	39	Solanum .....	81
XXXI. Incised Wounds .....	40	XXXIII. Camphor .....	82
XXXII. Gunshot Wounds .....	40	XXXIV. Coccus Indicis .....	83
XXXIII. Wounds of Different		XXXV. Alcohol, Ether, Chloro-	
Parts .....	41	form, Nitro-benzole,	
XXXIV. Detection of Blood-		etc. ....	83
stains .....	43	XXXVI. Nux Vomica, Strychnia	
XXXV. Death from Starvation ...	45	and Brucia .....	87
XXXVI. Death from Lightning .	45	XXXVII. Conium, Physostigma,	
		Aconite .....	88
		XXXVIII. Tobacco, Lobelia .....	89
		XXXIX. Hydrocyanic Acid .....	90
		XL. Oxalic Acid .....	92
		XLI. Digitalis .....	93
		XLII. Carbonic Acid Gas, etc. ....	94
		XLIII. Vegetable Purgatives .....	95
		XLIV. Abortives .....	96
		XLV. Irritants producing Ner-	
		vous Symptoms .....	97
		XLVI. Simple Irritants .....	97
		XLVII. Miscellaneous .....	98
<b>PART II.—TOXICOLOGY.</b>			
I. Definition of a Poison .....	46		
II. Classification .....	46		
III. Evidence of Poisoning .....	47		
IV. Symptoms and P.-M. appear-			
ances of different classes of			
Poisons .....	48		
V. Duty of Practitioner in Poi-			
soning .....	51		



# A I D S TO FORENSIC MEDICINE AND TOXICOLOGY.

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FORENSIC Medicine, Legal Medicine, or Medical Jurisprudence, is that portion of medical science which treats of the connection between law and medicine, and deals with cases connected with the administration of justice, and with questions involving the civil rights and social duties of individuals.

Toxicology is that division of Forensic Medicine which treats of the nature and detection of poisons, and the treatment of poisoned persons.

Under these two divisions the subject-matter of this book will be treated in the following pages.

## PART I.

# FORENSIC MEDICINE.



### I.—MEDICAL EVIDENCE.

WE cannot enter here into any lengthened account of the duties of the medical witness, but we may state that a medical man may be called upon as a *common* witness to state facts as seen by himself, or as an *expert* to interpret those facts or give an opinion on the statements made by others. A witness should also know that in every trial he may be subjected to *three* examinations: first, by the party on whose side he is engaged, and which is called the “examination in chief,” and in which he affords the basis for the next examination or “cross-examination” by the opposite side. The third is the “re-examination” by his own side. In the first he merely gives a clear statement of facts or of his opinions. In the next his testimony is subjected to rigid examination in order to weaken his previous statements; in the third he is allowed to clear up any discrepancies in the cross-examination, but he must not introduce any new matter which would render him liable to a cross-examination on it. The medical witness should answer questions put to him as clearly and as concisely as possible. He should make his statements in plain and simple language, avoiding as much as possible technical terms and figurative expressions, and should not quote authorities in support of his opinions.

With regard to notes, these should always be made at the time, on the spot, and may be used by the witness in court as a refresher to the memory, though not altogether to supply its place. *All* evidence is made up of testimony, but all testimony is *not* evidence. The witness should not therefore introduce hearsay testimony. In one case only is hearsay evidence admissible, and that is in the case of "dying declarations." These are accepted because the law presumes that a dying man *will* speak the truth. But the person must believe that he is *actually* on the point of death, *absolutely* no hope of recovery. If possible, a magistrate should take the dying declarations, but if he is not obtainable, the medical man, without any suggestions or comments of his own, should write down the statements made by the dying person, and see them signed and witnessed.

## II.—PERSONAL IDENTITY.

It is but seldom that medical evidence is required with regard to the identification of the living, though it may sometimes be so, as in the celebrated Tichborne case. The medical man may in such cases be consulted as to marks on the body, *nævi materni*, scars and tattoo marks, or with regard to the organs of generation in cases of doubtful sex. Tattoo marks may disappear during life, the vermilion marks more readily than those made with Indian ink, etc.; after death the colouring matter may be found in the glands. With regard to scars and their permanence, Casper says, "The scars occasioned by actual loss of substance, or by wounds healed by granulation, never disappear. But the scars of leech-bites, lancet-wounds, or cupping instruments, may disappear after

a lapse of time." It is extremely difficult, if not impossible, to give any certain or positive opinion of the age of a scar. The cicatrix resulting from a wound depends upon its situation. Of incised wounds an elliptical cicatrix is typical, linear being chiefly found between the fingers and toes. By way of disguise the hair may be dyed black with lead or nitrate of silver, detected by allowing the hair to grow or by steeping some of it in dilute nitric acid, and testing with iodide of potassium, etc., for lead, and hydrochloric acid for silver. The hair may be bleached with chlorine or peroxide of hydrogen, detected by letting the hair grow and by its unnatural feel and irregular bleaching.

With regard to the determination of cases of doubtful sex in the living, the following points should be noticed ; the size of the penis or clitoris, and whether perforate or not, the form of the prepuce, the presence or absence of nymphæ and of testicles. Openings must be carefully sounded as to their communication with bladder or uterus ; inquiry should be made as to menstrual or vicarious discharges, and the general development of the body, the growth of hair, the tone of voice, and the behaviour of the individual towards either sex carefully noted.

With regard to the identification of the dead in cases of death by accident or violence, the medical man's assistance may be called. The sex of the skeleton, if that only be found, may be judged from the bones of the female generally being smaller and more slender than those of the male, by the female thorax being deeper, the costal cartilages longer, the ilia more expanded, the sacrum more concave, the coccyx moveable, turned back, and the tuberosities of the ischia wider apart, the pubes shallow, and the whole pelvis shallower, and with larger outlets. But of all the above, which are usually given in books, the

only sign of any value is the roundness of the pubic arch in the female, as compared with the pointed arch in the male. Under puberty no sex can be determined from an examination of the bones.

Age may be calculated from the eruption of the teeth ; from the cartilages of the ribs, which gradually ossify as age advances ; from the angle formed by the ramus of the lower jaw with its body ; obtuse in infancy ; a right angle in the adult, and again obtuse in the aged from loss of the teeth ; and from the condition of the epiphyses generally, with regard to their attachment to their respective shafts.

In determining stature, if the whole skeleton be laid out and  $1\frac{1}{2}$  to 2 inches allowed for the soft parts, a fair estimate may be made.

### III.—IMPOTENCE AND STERILITY.

In the male, impotence may arise from physical or mental causes. The physical causes are : too great or too tender an age ; malformation of the genital organs, *cryptorchides*, defect or disease in the testicles ; constitutional disease or debility. Masturbation, and early and excessive sexual indulgence, are also causes. The mental causes include : passion, timidity, apprehension, aversion, and disgust.

In the female, impotence may be caused by narrowness of the vagina ; adhesion of the vulva ; absence of vagina ; imperforate hymen ; and tumours of the vagina.

Sterility in women may occur from the above-named causes of impotence, together with absence of the uterus and ovaries, or from great debility, constant amenorrhœa, dysmenorrhœa, or menorrhagia.

## IV.—RAPE.

Rape is defined in English law as “the carnal knowledge of a woman against her will.” *sine consentio*

The resistance of the woman *must be* to the utmost of her power, but if she yield through fear or duress it is still rape. The woman is a competent witness, but her statements may be impugned on the ground of her previous bad character, and evidence may be called to substantiate the charge. In Scotland *rape is the carnal knowledge of a woman forcibly and against her will, or of a girl below twelve years, whether by force or not*, and in this differs from English law, which makes the carnal knowledge of a child *below twelve years* a felony, and between *twelve and thirteen* a misdemeanour; over thirteen consent does away with the charge of rape. To constitute rape there must be *penetration*, *aliquid* but this may be of the slightest. Proof of actual *aliquo* emission of seed is now unnecessary.

Physical signs: in the adult the hymen may be ruptured, the fourchette lacerated, and blood found on the parts, together with scratches, and other marks on the person of the woman, signs of a struggle. In the child there may be no hæmorrhage, but there will be signs of bruising on the external organs, with probably considerable laceration of the hymen, the laceration, in some cases, extending into the rectum. Severe hæmorrhage and even death may follow a rape on a young child. The patient will have difficulty in walking, and in passing water and fæces. These signs last longer in children than in adults; but as a rule in the adult at least all signs of rape disappear in three or four days. Young delicate children may suffer from a discharge *per vaginam*, with swelling of the external genitals, simulating an attempt at rape.



The knowledge of this fact suggests a guarded opinion when children are brought to a surgeon for examination in suspected cases. Pregnancy may follow rape. Should the raped woman plead gonorrhœal infection it is not possible to distinguish the discharge from that of leucorrhœa.

Semen may be found on the linen of the woman and man, and will be recognised under the microscope by the presence in it of spermatozoa, minute filamentary bodies with a pear-shaped head ; but it must not be forgotten that the non-detection of spermatozoa is no proof of absence of sexual intercourse, for these bodies are not always present in the semen of even healthy adult young men. Spermatozoa must not be mistaken for the *Trichomas Vaginæ* found in the vaginæ of some women. The latter have tentacles surrounding the head, which is globular.

## V.—PREGNANCY.

The signs of the existence of pregnancy are of two kinds, uncertain and certain, or maternal and foetal. Amongst the former class are included : cessation of menstruation—this may occur without pregnancy ; morning sickness, salivation, enlargement of the breasts, and of the abdomen, due to causes other than pregnancy, quickening, and the occurrence of kiestein in the urine. It must be borne in mind that every woman with a big abdomen is not necessarily pregnant. The tests which afford conclusive evidence of the existence of a foetus in the uterus are : ballottement, the uterine souffle, and above all the pulsation of the foetal heart. The uterine souffle is synchronous with the maternal pulse ; the foetal heart is not, being about 120 beats per minute.

Evidence of pregnancy may also be afforded by the

discharge from the uterus of an early ovum, of moles, hydatids, etc. Disease of the uterus and ovarian dropsy may be mistaken for pregnancy; careful examination will determine the nature of the condition present. Pregnancy may be pleaded in bar of immediate capital punishment, in which case the woman must be shown to be "quick with child." A woman may also plead pregnancy to delay her trial in Scotland, and in both England and Scotland, in civil cases, to produce a successor to estates, to increase damages for seduction, etc. A woman may become pregnant within a month of her last delivery.

N.B.—In all cases of rape, pregnancy, etc., it must be seriously borne in mind that a medical man renders himself liable to heavy damages who examines any woman under any conditions against her will, and that the law will not support him so acting. If on being requested to allow of an examination the woman refuse, such refusal may go against her, but of this she is the best judge. The duty of the medical man ends on making the request.

## VI.—DELIVERY.

The signs of recent delivery are as follow: the face is pale, with dark circles round the eyes, the pulse quickened, the skin soft, warm, and covered with a peculiar sweat, the breasts full, tense and knotty, the abdomen distended, its integuments relaxed, with irregular light pink streaks on the lower part. The labia and vagina show signs of distension and injury; for the first three or four days there is a discharge from the uterus, more or less bloody in character; during the next four or five days it becomes of a dirty green colour, and in a few days more of a yellowish milky mucous character, continuing for four



or five weeks. The uterus may be felt for two or three days above the pubis as a hard round ball, regaining its normal size in about eight weeks after delivery. Most of these signs disappear about the tenth day, after which it becomes impossible to fix the date of delivery.

In the dead, the external parts have the same appearance as given above. The uterus will vary in appearance according to the time elapsed since delivery. If death occurred immediately after delivery, the uterus will be wide open, about 9 or 10 inches long, with clots of blood inside, and its inner surface lined by decidua.

The signs of a previous delivery consist in silvery streaks in the skin of the abdomen, which, however, may be due to distension from other causes ; similar marks on the breast, circular and jagged condition of the os uteri, the virgin os being oval and smooth, marks of rupture of the perineum or fourchette, absence of the vaginal rugæ, dark coloured areola round the nipples, etc. The difference between the virgin *corpus luteum* and that of recent pregnancy is not so marked as to justify a confident use of it for medico-legal purposes. See Dr. Arthur Farre on the "Uterus and its Appendages," in the "Cyclopædia of Anatomy and Physiology."

## VII.—FŒTICIDE, OR CRIMINAL ABORTION.

This consists in giving to any woman, or causing to be taken by her, with intent to procure her miscarriage, any poison or other noxious thing, or using for the same purpose any instruments or other means whatsoever ; also in the use of the same means, with the same intent, by any woman, being with child. Any person or persons so acting shall be

guilty of felony, and any person procuring drugs or instruments for a like purpose shall be guilty of a misdemeanour. It is not necessary that the woman be *quick* with child. "The offence is the intent to procure the miscarriage of any woman, *whether she be or be not with child.*" When from any causes it is necessary to procure abortion, a medical man should only do so after consultation with a brother practitioner. No medical man should give even the most harmless medicine where he suspects the possibility of pregnancy, or he may render himself liable to grave suspicion should the woman abort. In medicine, an *abortion* is said to occur when the foetus is expelled before the sixth month; after that it is *premature birth*. In law, however, any expulsion of the contents of the uterus before the full time is an *abortion* or *miscarriage*. In deciding whether any substance expelled from the uterus is really a foetus, or a mole, and therefore the result of conception, or the coat of the uterus, and unconnected with pregnancy, the examination of the substances expelled must be carefully made. Moles are blighted foetuses. An examination of the woman will be necessary, though it is not easy, during the early months of pregnancy, and especially in those who have borne children, to say whether abortion has taken place or not. The history must be inquired into,—the regular or exceptional use of drugs to promote menstruation is important, for in the former case no criminal intent may exist, although pregnancy be present. The state of the breasts, the hymen and the os uteri, should all be carefully examined. Putting a few apparently unimportant questions, as to the frequent use of purgatives, the presence or absence of constipation, will often assist the diagnosis as showing that the woman has acted in an unusual

manner. Abortion may be procured by the introduction of instruments, by violent blows, etc., or by the administration of certain drugs, as ergot, savin, pennyroyal, etc. The latter are not as a rule very effective, there being no really known abortive drug.

## VIII.—INFANTICIDE.

Infanticide, murder of a new-born child, is not treated as a special crime, but is tried by the same rules as in cases of felonious homicide. To constitute "live birth," the child must have been alive after its body was entirely born—that is, entirely outside the maternal passages—and it must have had an independent circulation, though this does not imply the severance of the umbilical cord. Every child is now held in law to be born dead until it has been shown by the prosecution to have been born alive. With regard to the question of the maturity of a child, the differences between a child of six or seven months, and one at full term, may be stated as follow :

Between the sixth and seventh month : length of child, 10 to 14 inches. That is, the length of the child after the fifth month is about double the lunar months. Weight, 1 to 5 lb. Skin, dusky red, covered with down and sebaceous matter ; *membrana pupillaris* disappearing ; nails not reaching to ends of fingers ; meconium at upper part of large intestine ; testes near kidneys ; no appearance of convolutions in brain ; points of ossification in four divisions of sternum.

At nine months : length of child, 18 to 22 inches. Weight, about 7 to 8 lb. Skin rosy ; down about shoulders ; sebaceous matter sometimes on the body ; hair may be about an inch long on head ; testes past inguinal ring ; clitoris covered by the labia ; mem-

brana pupillaris disappeared ; nails reach to ends of fingers ; meconium at termination of large intestine ; points of ossification in centre of cartilage at lower end of femur, about  $1\frac{1}{2}$  to  $2\frac{1}{2}$  lines in diameter. Umbilicus midway between the ensiform cartilage and pubis.

Should the charge of infanticide not be proved, the woman in England may be tried for concealment of birth ; in Scotland for concealment of pregnancy, whether married or unmarried, if she conceal her pregnancy during the whole time and do not call for assistance in the birth. The law in Scotland is weak, as it makes no provision for a woman making known her pregnancy for the purpose of infanticide ; thus it does not matter to whom or for what purpose she proclaims her pregnancy, so long as she does so.

## IX.—EVIDENCES OF LIVE BIRTH.

The signs of live birth, prior to respiration, are divided into negative and positive. A negative opinion may be formed when evidence is found of the child having undergone intra-uterine maceration. In this case the body will be flaccid and flattened ; the ilia prominent ; the head, from incipient putrefaction, soft and yielding ; the cuticle more or less detached ; the skin of a whitish or brownish-red colour, covered with a soapy fluid ; the cavities filled with abundant bloody serum ; the umbilical cord straight and flaccid.

A positive opinion may be justified when such injuries are found on the body as could not have been inflicted during birth, and attended with such hæmorrhage as could only have occurred while the blood was circulating. Fractures of the cranium from accidental falls are as a rule stellate, situated in the

parietal protuberance ; from violence the fractures are more extensive.

The evidences of live birth, after respiration has taken place, are usually deduced from the condition of the lungs ; though signs are also found in some of the other organs. Crystals of uric acid are said to be found in the pelves of the kidneys of a child that has breathed. The diaphragm is more arched before than after respiration, and rises higher in the thorax in the former case than in the latter. The lungs, before respiration, are situated at the back of the thorax, and do not fill that cavity. After respiration they occupy the whole thorax ; the portions containing air are of a light-red colour, becoming scarlet, and crepitate under the finger. The lungs are also mottled, due to islands of aërated tissue surrounded by arteries and veins. The weight of the lungs before respiration is about 874 grains ; after about an hour's respiration 918 grains ; twelve hours 853 grains : this test, however, is of little use. The ratio of the weight of the lungs to that of the body (Ploucquet's test), which is also but little to be relied on, is, before respiration, about 1 to 70 ; after, 1 to 35. Lungs in which respiration has taken place float in water : those in which it has not, sink. There are exceptions to this rule, on which, however, is founded the hydrostatic test. As originally performed, this test consisted merely in placing the lungs, with or without the heart, in water, and noticing whether they sank or floated. The test is now modified by pressure, and by cutting the lungs up into pieces.

The objections to the test, as originally performed, were :—1. That the lungs may sink as the result of disease, *e.g.*, double pneumonia. 2. That respiration may have been so limited in extent that the lungs may sink. 3. Putrefaction may cause the lungs to float



when respiration has not taken place. 4. The lungs may have been inflated artificially. Few of these objections apply, however, when the hydrostatic test, modified by pressure, is employed. To take these objections in detail it may be stated:—1. If the lungs sink from disease, the question of live birth is answered. 2. This objection is too refined for practical use. The lungs sink, there is an absence of any of the signs of suffocation, and the matter ends. The examiner has only to describe the conditions which he finds, and is not required to indulge in conjectures as to the amount of respiration which may or may not have taken place. 3. Air due to putrefaction can be expelled by pressure, and is not found in the air-cells. The lungs putrefy late, hence in a fresh child putrefaction of the lungs is absent; in a putrefied child, if the lungs sink, it must have been still-born. 4. Common-sense asks who in their senses is likely to attempt the difficult operation of inflation. The mother, anxious to conceal her shame? It must further be remembered that the cases which come under investigation on the ground of infanticide are cases of uncomplicated, rapid labour, completed in seclusion. To apply pressure, the finger and thumb under water may be sufficient; if not, the fragment may be placed in a cloth and the ends twisted opposite ways; if still further pressure be required, the cloth containing the lung may be trodden by the foot. The so-called *emphysema pulmonum neonatorum* is simply incipient putrefaction.

In addition to the hydrostatic test, live birth may be deduced from the following conditions: The *stomach* may contain milk or food, recognised by the microscope and by Trommer's test for sugar; the *large intestines* in still-born children are filled with meconium; in those born alive they are usually

empty ; the *bladder* is generally emptied soon after birth ; the *skin* is in a condition of exfoliation soon after birth. The *organs of circulation* undergo the following changes after birth, and the extent to which these changes have advanced will give an idea of how long the child has lived : The *ductus arteriosus* begins to contract within a few seconds of birth ; at the end of a week it is about the size of a crowquill, and about the tenth day is obliterated. The *umbilical arteries and vein* :—The arteries are remarkably diminished in calibre at the end of twenty-four hours, and obliterated almost up to the iliacs in three days ; the umbilical vein and the ductus venosus are generally completely contracted by the fifth day. The *foramen ovale* becomes obliterated at extremely variable periods, and may continue open even in the adult.

The umbilical cord in a new-born child is fresh, firm, round, and bluish in colour : blood is contained in its vessels. The cord may be *ruptured* by the child falling from the maternal parts in a precipitate labour, and yet the ruptured parts present *all* the appearances of being *cut*. It is seldom that a child bleeds to death from an untied or cut umbilical cord, and the chances in a torn cord are still more remote. The changes in the cord are as follow :—first it *shrinks* from the ligature towards the navel ; this change may begin early, and is rarely delayed beyond thirty hours : the cord becomes flabby, and there is a distinct inflammatory circle round its insertion. The next change is that of *desiccation* or *mummification* : the cord becomes reddish-brown, then flattened and shrivelled, then translucent and of the colour of parchment, and falls off about the fifth day. The third stage, that of *cicatrization*, then ensues about the tenth to the twelfth day. The bright red rim round the insertion of the cord, with inflammatory thickening and slight

purulent secretion, may be considered as positive evidence of live birth, and the stage at which the separation of the cord by ulcerative process has arrived will point to the probable duration of time the child has existed after birth, and answer the question, How long did the child live?

## X.—CAUSE OF DEATH IN THE FŒTUS.

The death of the foetus may be due to, 1. Its immaturity. 2. Complications occurring during or immediately after birth, which may either be unavoidable or inherent in the process of parturition, or may be induced with criminal intent. Under the former category come such accidents as the pressure of tumours in the pelvic passages, or disease of the bones in the mother, or pressure on the cord from malposition of the child during labour, by strangulation, from the funis being round the neck, or falls on the floor in sudden labours. Where the death of the foetus has been induced with criminal intent, it may be due to punctured wounds of the fontanelles, orbits, heart, or spinal marrow; dislocation of the neck; separation of the head from the body; fracture of the bones of the head and face; strangulation; suffocation; drowning in the closet pan or privy, or it may be thrown into water. Under the head of infanticide by *commission* we have injuries of all kinds; under infanticide by *omission*, neglecting to tie the cord, to provide food, clothes, warmth, etc., for the new-born child.

## XI.—LEGITIMACY.

A child born in wedlock is presumed to have the mother's husband for its father. This may, however, be open to question upon the following grounds:—



Absence or death of the reputed father ; impotence or disease in the husband preventing matrimonial intercourse ; premature delivery in a newly-married woman ; want of access ; when the woman marries again immediately on the death of her husband. In the last case, where either husband might have been the father, the child at the age of twenty-one may, it is said, select its father.

## XII.—DURATION OF PREGNANCY.

The natural period of gestation is considered as forty weeks, ten lunar months, nine calendar months, or 280 days. In Scotland ten months is held as the limit. This period, however, may be in rare cases exceeded, and, on the other hand, the child may often be born at a shorter term. There is considerable difficulty in many cases in fixing the date of conception. The data from which it is calculated are the following :—1. *Peculiar sensations attending conception*, which are not sufficiently defined to be recognised by those conceiving for the first time. 2. *Cessation of the catamenia*. Other causes may, however, cause this ; and on the other hand, a woman may menstruate during the whole period of her pregnancy. This datum also gives a variable period, and may involve an error of several days or a month, for the menses may be arrested by cold, etc., at one monthly period, and the woman become pregnant before the next. 3. *The period of quickening*. This, when perceived (which is not always the case), also occurs at variable periods from the tenth to the twenty-sixth week. Pregnancy may occur without quickening and quickening without pregnancy. 4. *A single coitus*. This, which is the only really accurate mode of reckoning, is, of course, seldom available.

## XIII.—VIABILITY OF CHILDREN.

Seven months, or 210 days, is generally considered as the earliest period at which a child can be born capable of living and attaining to maturity. Cases, however, have been recorded in which children born at six months have been reared. The signs of immaturity and maturity may be thus tabulated :—

## IMMATURITY.

Centre of body high ; head disproportionate in size ; membrana pupillaris present ; testicles undescended ; deep red colour of parts of generation ; intense red colour, mottled appearance, and downy covering of skin ; nails not formed ; feeble movements ; inability to suck ; necessity for artificial heat ; almost unbroken sleep ; rare and imperfect discharges of urine and meconium ; closed state of mouth, eyelids, and nostrils.

## MATURITY.

Strong movements and cries as soon as born ; body clear, red colour, coated with sebaceous matter ; mouth, nostrils, eyelids, and ears open ; skull somewhat firm, and fontanelles not far apart ; hair, eyebrows, and nails perfectly developed ; testicles descended ; free discharge of urine and meconium ; power of suction, indicated by seizure on the nipple or a finger placed in the mouth.

## XIV.—SUPERFŒTATION.

By Superfœtation is meant the conception, by a woman already pregnant, of a second embryo, resulting in the birth of two children, at the same time, differing much in their degree of maturity, or in two separate births, with a considerable interval between. The possibility of the occurrence of superfœtation has been doubted, but there are some well-authenticated cases which seem to countenance the theory of a double conception, especially as it has been shown that the os uteri is *not* closed, as was once supposed, *immediately*

*on conception.* Should an egg escape into the uterus, it may become impregnated a month or so after a previous conception.

## XV.—INHERITANCE.

In order to inherit, the child must be born alive ; must be born during the lifetime of the mother ; must be born capable of inheriting, that is to say, monsters are incapable of inheriting. There is a mode of inheritance called "tenancy by the courtesy," as follows: "When a man marries a woman seised of an estate of inheritance, and has, by her, issue born alive, which was capable of inheriting her estate ; in this case he shall, on the death of his wife, hold the lands for his life as tenant by the courtesy of England." The meaning of the words "born alive" in this instance is not the same as in cases of infanticide—any kind of motion being held as evidence of live birth in questions of tenancy by courtesy.

## XVI.—FEIGNED DISEASES.

We have not space here to give a long list of feigned diseases, nor to describe all the methods which have been employed to aid deception. The following hints, however, may be useful to a medical man when called to what he believes to be a case of malingering :—Do not be satisfied with one visit only, but go again and enter unannounced ; see that the patient is watched between the visits ; examine each organ separately, compare its condition with the statement of the patient, and note any discrepancies between his account of his

symptoms and the real symptoms of disease; ask questions the reverse of the patient's statements, or take them for granted, and he will often be found to contradict himself; have all dressings and bandages removed; suggest, in the hearing of the patient, some heroic methods of treatment—the actual cautery, or some severe surgical operation, for example; chloroform will be found of great use in the detection of many sham diseases.

## XVII.—MENTAL UNSOUNDNESS.

It will be impossible to give any detailed account of so important, difficult, and interesting a subject as insanity. We can only make a few short remarks on its various forms, with some reference to its legal relations.

According to English law, madness absolves from all guilt, but in order to excuse from punishment on this ground it must be proved that the individual was not capable of distinguishing right from wrong in relation to the particular act of which he is accused, and that he did not know at the time of committing the crime that the offence was against the laws of *God* and *nature*.

Under the term *non compos mentis* four classes were included by Lord Coke, viz., “1. *Idiota*, which from his nativity, by a perpetual infirmity, is *non compos mentis*. 2. He that by sickness, grief, or other accident, wholly loseth his memory and understanding. 3. A lunatic that hath sometimes his understanding and sometimes not, *aliquando gaudet lucidis intervallis*, and, therefore, he is called *non compos mentis*, so long as he hath not understanding. 4. He that by his own

vicious act for a time depriveth himself of his memory and understanding, as he that is drunken."

Lunatics are competent witnesses in relation to testimony as in relation to crime, if they understand the nature of an oath, and the character of the proceedings in which they are engaged. The judge, as in the case of children, examines the lunatic tendered as a witness, as to his knowledge of the nature and obligation of an oath, and if satisfied he shall allow him to be sworn.

A person, if suffering from such a state of mental unsoundness as to be unable to take care of his property, may be placed under the care of the Court of Chancery. The Court then administers his property, and otherwise allows him entire freedom of action.

With regard to the care of lunatics, no person is allowed to receive more than one lunatic into his house, unless such house is licensed and the proper certificates have been signed. One patient may be taken without the house being licensed, but the usual certificates must in all cases be signed, and the Lunacy Commissioners communicated with. If a person receives another not of unsound mind into his house, and such person becomes subsequently insane, the person so keeping him renders himself liable to heavy penalties, unless the legal certificates are at once procured, and the Commissioners of Lunacy communicated with.

At common law it appears that a lunatic cannot be placed in an asylum unless dangerous to himself or to others, but under the Lunacy Acts the placing of a madman in an asylum is considered as a part of the treatment with a view to the cure of the patient.

Various systems of classification have been adopted at the suggestion of different authorities. One well suited for our purpose is that adopted by Dr. Guy, in his "Forensic Medicine." which is as follows :—

## UN SOUNDNESS OF MIND.

AMENTIA.	DEMENTIA.	MANIA.
1. Idiocy.	1. Acute or	1. General.
2. Imbecility.	Primary.	{ General. { Partial { Monomania. { Melancholia
3. Cretinism.	2. Chronic, or	
	Secondary.	{ General. { Partial { Homicidal. { Suicidal, etc., etc.
	3. Senile Dementia.	
	4. Paralytic Dementia, or General Paralysis of the Insane.	

## XVIII.—IDIOCY, IMBECILITY, CRETINISM.

*Idiocy* is not a disease, but a congenital condition in which the intellectual faculties are either never manifested, or have not been sufficiently developed to enable the idiot to acquire an amount of knowledge equal to that acquired by other persons of his own age, and in similar circumstances with himself. Idiots as a rule are deformed in body as well as deficient in mind. Their heads are generally small and badly-shaped, and their features ill-formed and distorted. The complexion is sallow and unhealthy; the limbs imperfectly developed, and the gait is awkward, shambling, and unsteady. In his legal relations an absolute idiot is civilly disabled and irresponsible, but in regard to crime or as a witness, see remarks just made with regard to lunatics.

*Imbecility* is a form of mental defect not usually congenital, but commencing in infancy. The line of demarcation between the imbecile and the idiot may be found in the possession by the former of the faculty of speech, in distinction from the mere parrot-like utterance of a few words, which can be taught the



idiot. Imbecility may be intellectual, moral, or general.

*Cretinism* is a form of amentia, which is endemic in certain districts, especially in some of the valleys of Switzerland, Savoy, and France. The malady is not congenital, but its symptoms usually appear within a few months of birth. The characteristics of this form of idiocy are, an enlarged thyroid gland, constituting a goitre or bronchocele, a high-arched palate, dwarfed stature, squinting eyes, sallow complexion, small legs, conical head, large mouth, and indistinct speech.

## XIX.—DEMENTIA: ACUTE, CHRONIC, SENILE, AND PARALYTIC.

In dementia the mental aberration does not occur until the mind has become fully developed, thus differing from amentia, which is congenital, or comes on very early in life.

*Acute dementia*.—This is a condition of profound melancholy or stupor, which arises from sudden mental shock, the mind being, as it were, arrested and fixed in abstraction on the event.

*Chronic dementia* is generally caused by the gradual action on the mind of grief or anxiety, by severe pain, mania, apoplexy, paralysis, or repeated attacks of epilepsy.

*Senile dementia* is a form which is incidental to aged persons, and commences gradually with such symptoms as loss of memory for recent events, dulness of perception, and inability to fix the attention. Later on, the reasoning powers begin to fail, and, finally, memory, reason, and power of attention are quite lost, the muscular power and force remaining intact.

In the last stage there is simply bare physical existence.

*Paralytic dementia, general paralysis of the insane.*—This is a most interesting form of dementia. Its most prominent and characteristic symptom consists in delusions of great power, exalted position, and unlimited wealth. It is accompanied with progressive bodily and mental decay. Women are rarely affected by it, and it generally commences in men about middle age, and lasts from a few months to three years. Paralytic symptoms first appear in the tongue, lips, and features; the speech becomes thick and hesitating. The paralytic symptoms gradually go on increasing, the sphincters refuse to act, and death may occur from suffocation and choking. Sometimes, during the earlier stages especially, there may be maniacal paroxysms or epileptic fits. The delusions remain the same throughout, the patient always expresses himself as being happy, and his last words will probably have reference to money and his other absurd delusions.

## XX.—MANIA.

Under the term mania are included all those forms of mental unsoundness in which there is undue excitement. It is divided into general, intellectual, and moral, and each of the two latter classes again into general and partial.

*General mania* affects the intellect as well as the passions and emotions. Mania is usually preceded by an incubative period in which the patient's general health is affected. The duration of this period may vary from a few days to fifteen or twenty years. When the disease is established, the patient has paroxysms of violence directed against himself, as well



as others ; he tears his clothes to pieces, either abstains from food and drink, or eats voraciously, and sustains immense muscular exertion without apparent fatigue. The face becomes flushed, the eye wild and sparkling ; there is pain, weight, and giddiness in the head, with restlessness.

*General intellectual mania*, attacking the intellect alone, is rare ; but some one emotion or passion, as pride, vanity, or love of gain, may obtain ascendancy, and fill the mind with intellectual delusions. A *delusion* may be defined as an affection of the mind, a chimerical thought ; an *illusion*, an affection of the senses, counterfeit appearances : hence we speak of a delusion of the mind, an illusion of the senses. An *hallucination* is a sensation which is supposed by the patient to be produced by external impressions, although no material object acts upon his senses at the time.

*Partial intellectual mania*, or *monomania*, also called *melancholia*, is a form of the disease in which the patient becomes possessed of some single notion, contradictory alike to common sense and his own experience.

*General moral mania*.—Pritchard thus defines moral mania :—"A morbid perversion of the natural feelings, affections, inclinations, temper, habits, moral dispositions, and natural impulses, without any remarkable disorder or defect of the intellect, or knowing and reasoning faculties, and particularly without any insane illusion or hallucination."

*Partial moral mania*.—In this form one or two only of the moral powers are perverted. There are several forms of this, viz. :—

*Kleptomania*, a propensity to theft. More common in women in easy circumstances.

*Dipsomania*, an insatiable desire for drink.

*Erotomania*, or amorous madness. When occurring in women this is also called *Nymphomania*, and in men *Satyriasis*. It consists in an uncontrollable desire for sexual intercourse.

*Pyromania*, an insane impulse to set fire to everything.

*Homicidal mania*, a propensity to murder.

*Suicidal mania*, or propensity to self-destruction. Some consider suicide as always a manifestation of insanity.

*Puerperal mania*.—This form of mania attacks women soon after childbirth. There is in many cases a strong homicidal tendency against the child.

*Mania with lucid intervals*.—In many cases mania is intermittent, or recurrent, in its nature, the patient in the interval being in his right mind. The question of the presence or absence of a lucid interval, frequently occurs where attempts are made to set aside wills made by persons having property. In these cases the law, from the reasonableness of the provisions of the will, may assume the existence of the lucid interval. A will made during a lucid interval is valid. When an attempt is made to set aside the provisions of a will on the ground of insanity in a person not previously judged insane, the plaintiff must show that the testator was mad; when the provisions of the will of a lunatic are attempted to be upheld, the plaintiff must show that the will was made during a lucid interval.

## XXI.—EXAMINATION OF PERSONS OF UNSOUND MIND.

The following hints with regard to the examination of patients supposed to be insane will be useful. The general appearance and shape of head, complexion and

expression of countenance, gait, movements, and speech, should be carefully noted. The state of the general health, appetite, bowels, tongue, skin, and pulse should be inquired into; and in women the state of the menstrual function must be noticed. The family history must be traced out, and the personal history taken with care, as to whether the unsoundness came on late in life or followed any physical cause. Ascertain whether this is a first attack, whether the patient has suffered from epilepsy, has squandered his money, grown restless, had absurd delusions, etc., etc. In order to ascertain the capacity of the mind, questions should be asked with regard to age, birth-place, profession, number of family, common events, day of week, month and year, name of the reigning sovereign, etc. The power of performing simple arithmetical operations may be tested. More than one visit should be made. The examiner should be careful to ask questions adapted to the station of life of the supposed lunatic, a man is not necessarily mad because he cannot perform "simple arithmetical operations," or does not know about things with which his questioner is well acquainted. The opinion of a supposed lunatic that his examiner's feet *were large* was not considered by the Commissioners among the facts indicating insanity, yet statements quite as absurd are made by medical men as "facts of insanity" observed by themselves. Some well marked delusion should be discovered.

In a lunacy certificate, except in the case of a pauper patient, there are required the signatures of two independent medical men, and of a relation or a friend. The medical men must not be in partnership, or in any way interested in the patient; they must make separate visits, at different times, and write on the proper forms the facts observed by themselves and those

observed by others, giving the name of the informer. A certificate is valid only for seven days. In very urgent non-pauper cases the signature of one medical man is sufficient, but such certificate is only valid for three days, and must be supplemented by another signed as above directed. Medical men, from the experience gained by the Mrs. Weldon trials, will be careful how they sign certificates of insanity.

## XXII.—EXAMINATION OF PERSONS FOUND DEAD.

When a medical man is called to a case of sudden death, he should carefully note anything likely to throw any light on the cause of death. He should also notice the place where the body was found, the position and attitude of the body, the soil or surface on which the body lies, the position of surrounding objects, and the condition of the clothes.

If required to make a post-mortem examination, every cavity and important organ of the body must be carefully and minutely examined, the seat of injury being inspected first.

## XXIII.—MODES OF SUDDEN DEATH.

There are three modes in which death may occur—by syncope, asphyxia, and coma.

*Syncope*, or arrest of the heart's action, may occur from—1. Deficiency of blood, due to hæmorrhage. 2. The effects of certain diseases and poisons. The P.M. signs of this mode of death are: A normal quantity of blood in the heart; blood in the veins and arteries; no engorgement of brain and lungs.

*Asphyxia*, or *apnœa*, death from impediment to the action of the lungs, caused by—1. Certain diseases of

the lungs. 2. Mechanical obstruction to respiration. P.M. shows engorgement of the pulmonary artery, right cavities of heart and venæ cavæ ; the left side of the heart and the aorta, etc., being comparatively empty.

*Coma*.—Death due to some cerebral mischief, caused by apoplexy, fracture of the cranial bones, compression, etc. The P.M. signs are congestion of the membranes and substance of the brain and lungs, with more or less blood in the right cavities of the heart.

## XXIV.—SIGNS OF DEATH.

1. *Cessation of the circulation and respiration*, no murmur being heard by the stethoscope. 2. *The state of the eye*, in which there is a tenacious glairy mucus on the conjunctiva, with a collapsed and wrinkled state of the cornea. 3. *Absence of sense and motion*; these occur in suspended animation. 4. *The facies Hippocratica*—not a safe sign, being frequently absent in sudden death. 5. *The state of the skin*; pallor, livid discolorations, and loss of elasticity, have been mentioned among the signs of death. 6. *Extinction of muscular irritability*. The above signs afford no means of determining how long life has been extinct. The following however, do: *Extinction of animal heat*: the average internal temperature of the body is from 98° to 100° F. The time taken in cooling is from 15 to 20 hours, but it may be modified by the kind of death, the presence or absence of clothing on the body, the surrounding temperature, and the stillness or otherwise of the air about the body. Still the body, other things being equal, may be said to be *quite cold* in about *twelve hours*.

*Hypostasis* or *post-mortem staining* is due to the settling down of the blood in the most dependent

parts of the body while the body is cooling. It is a sure sign of death, and occurs in all forms of death—even to that due to hemorrhage—although not so marked in extent. Post-mortem staining, *cadaveric lividity*, begins to form in from 8 to 12 hours after death, and its position on the body will help to determine the length of time the body has lain in the position in which it was found. It must be distinguished from ecchymosis the result of a bruise by making an incision into the part; in the former case a few small bloody points of divided arteries will be seen, in the latter coagula. Internally, hypostasis must not be mistaken for congestion of the brain or lungs, or the results of inflammation of the intestines. If the intestine is pulled straight, inflammatory redness is continuous, hypostasis is disconnected. About the neck hypostasis must not be mistaken for the marks of a cord, etc.

*Cadaveric rigidity—Rigor mortis.* For some time after death the muscles continue to contract under stimuli. When this irritability ceases, and it seldom exceeds two hours, rigidity sets in, and in *all* cases precedes putrefaction. It is caused by the coagulation of the muscle fibrin. It commences in the muscles of the back of the neck and lower jaw, and then passes into the muscles of the face, front of the neck, chest, upper extremities, and lastly to the lower extremities.

It has been noticed in the new-born infant, but not in the foetus. It lasts from 16 to 20 hours, or more. In lingering diseases, or after violent exercise, it sets in quickly, and disappears in two or three hours; in those who are in perfect health and die from accident it does not come on until from 10 to 24 hours, and may last three or four days. This is also the case in poisoning by strychnia, if the muscles have not been exhausted by frequent and violent fits. Rigor mortis



must be distinguished from *cadaveric spasm* or the *death clutch*; in the former, articles in the hands are readily removeable, in the latter this is not the case. In tetanic spasm the limbs when bent return to their former position; not so in rigor mortis.

*Putrefaction* appears in from one to three days after death as a greenish-blue discoloration of the abdomen; in the drowned, over the head and face. This increases, becoming darker and more general, a strong putrefactive odour is developed, the thorax and abdomen become distended with gas, and the epidermis peels off. The muscles then become pulpy, and assume a dark greenish colour, the whole body at length becoming changed into a soft, semi-fluid mass. The organ first showing the putrefactive change is the trachea, that which resists putrefaction longest is the uterus. These putrefactive changes are modified by the fat or lean condition of the body, the temperature (putrefaction taking place more rapidly in summer than in winter), access of air, the period, place, mode of interment, age, etc. Bodies which remain in water putrefy more slowly than those in air.

*Saponification*.—In bodies which are very fat and have lain in water or moist soil for from one to three years this process takes place, the fat uniting with the ammonia given off by the decomposition to form *Adipocere*. This consists of a margarate of ammonia with lime, oxide of iron, potash, certain fatty acids, and a yellowish odorous matter. It has a fatty unctuous feel, is either pure white or pale yellow, with an odour of decayed cheese. Small portions of the body may show signs of this change in six weeks.

## XXV.—DEATH BY DROWNING.

Death by drowning occurs when breathing is arrested by watery or semi-fluid substances, blood, urine, mud, etc. The fluid acts mechanically by entering the air-cells of the lung and preventing the due oxidation of the blood. The post-mortem appearances include those usually present in death by apnoea (Aid xxiii.), and also the following, peculiar to death by drowning: Excoriations of the fingers, with sand or mud under the nails; fragments of plants grasped in the hand; water in the stomach (this is a vital act, and shows that the person fell into the water alive); froth at the mouth and nostrils; froth, water, and sand, or mud, in the air passages; cutis anserina, and *contraction* and *retraction* of the penis. The last is a very constant and valuable sign. Froth like that of soap-suds in the trachea is a vital act, and must not be mistaken for the tenacious mucus of bronchitis, etc. The presence of vomited matters in the trachea and bronchi is also a valuable sign of drowning. In case of wounds about the body, the place where the body was found must be examined for stakes, etc.

To *restore the drowned*, the body should be rapidly stripped and dried, the clothes rolled up and placed under the pit of the stomach, the body turned over in the prone position and the tongue drawn out of the mouth. The surgeon, standing over the patient, presses on the back of the thorax two or three times to expel the water from the lungs and trachea. The body is then turned over, the pad of clothes being placed in the small of the back, and the surgeon with his hands on each side of the thorax imitates the acts of respiration. The hands should be



placed over the head and the tongue drawn out to one side of the mouth.

## XXVI.—DEATH BY HANGING.

In hanging, death occurs by apnœa, as in drowning; or from the force of the fall dislocating or fracturing the cervical vertebræ or the odontoid process. Sensibility is soon lost in hanging, and death is complete in four or five minutes. The eyes, in some cases, are brilliant and staring, tongue swollen and livid, blood or bloody froth is found about the mouth and nostrils, and the hands are clenched. In other cases the countenance is placid, with an almost entire absence of the signs just given. The mark on the neck, which may be more or less interrupted by the beard, etc., shows the course of the cord, which in hanging is obliquely round the neck, but straight round in strangulation; and on dissection, the muscles and ligaments of the windpipe may in judicial hanging be found stretched, bruised, or torn, and the inner coats of the carotid arteries are sometimes found divided. In ordinary suicidal hanging there may be entire absence of injury to the soft parts about the neck, the length of the drop modifying these appearances. The mark of the cord is not a sign of hanging, is a *purely cadaveric phenomenon*, and may be produced some hours after death.

## XXVII.—DEATH BY STRANGULATION.

This differs from hanging, in that the body is not suspended. It may be effected by a ligature round the neck, or by direct pressure on the windpipe with the hand, in which case death is said to be caused

by *throttling*. Strangulation and throttling are as a rule homicidal ; hanging may be either accidental or suicidal, and the same may be said of drowning.

## XXVIII.—DEATH BY SUFFOCATION.

This includes all cases of apnoea not produced by direct pressure on the windpipe, except drowning. Suffocation may take place from—1. Stoppage of the mouth and nose by accident or force. 2. Mechanical pressure on the chest, or disease, pneumonia, etc. 3. Closure of the glottis, as by food or other foreign bodies. 4. Vapours, as the vapour of charcoal. 5. Strychnia, conium, etc., which by contracting the muscles of the chest produces death by suffocation.

In some cases of death by suffocation there are no external marks ; but internally there are the signs of asphyxia, with unusual fluidity of the blood.

## XXIX.—WOUNDS AND MECHANICAL INJURIES.

A wound may be defined, according to Dr. Taylor, as “a breach of continuity in the structures of the body, whether external or internal, suddenly occasioned by mechanical violence.” The law, however, does not define “a wound,” but the *true skin must be broken*. Wounds are dangerous from shock, hæmorrhage from the supervention of erysipelas, pyæmia, etc., and from *malum regimen* on the part of the patient or surgeon. *Is the wound dangerous to life?* This question can only be answered by a full consideration of all the circumstances of the case ; a guarded prognosis is wise in all cases. Burns are caused by flames, highly heated solids, or very cold solids, as solid carbonic acid ; scalds by hot fluids. Burns

may cause death from internal hæmorrhage and ulceration of the duodenum, or from shock, prolonged ulceration of the part causing exhaustion, etc. A burn inflicted during life is followed by a bleb containing serum over a red inflamed surface; after death a bleb, if present, does not contain fluid, and there are no signs of vital reaction. There are six degrees of burns. 1. Superficial inflammation. 2. Formation of vesicles. 3. Destruction of superficial layer of skin. 4. Destruction of cellular tissue. 5. Deep parts charred. 6. Carbonization of bones, etc. This large subject of wounds will be considered under various heads.

### XXX.—CONTUSED WOUNDS AND INJURIES UNACCOMPANIED BY SOLUTION OF CONTINUITY.

If a blow be inflicted with a blunt instrument, there is produced a bruise or *ecchymosis*, of which it is unnecessary here to describe the appearance and progress. A bruise may be distinguished from a post-mortem stain by the former not being confined to the cellular membrane, but involving the substance of the true skin. It may be required to distinguish between bruises inflicted during life and after death. In bruises inflicted during life the skin is dark, discoloured, and thickened by the infiltration of blood into its whole thickness. A heavy blow given within two hours of death may present signs like an injury inflicted before death. When a cut is made into a *post mortem* stain no clot is found, but only a few bloody points—divided capillaries. If on cutting into the bruise the effusion of blood is considerable, and the clots large, the presumption is strongly in favour of its having been inflicted during life.

### XXXI.—INCISED WOUNDS AND THOSE ACCOMPANIED BY SOLUTION OF CONTINUITY.

These comprise incised, punctured and lacerated wounds. In a recent incised wound, inflicted during life, there is copious hæmorrhage, the cellular tissue is filled with blood, the edges of the wound gape with coagula between. An incised wound may be produced by a hard blunt weapon over a bone, shin or cranium, etc. The distinction between incised wounds inflicted during life and after death may be found in the fact, that in a wound inflicted during life there are the above characters; whereas, in a post-mortem incised wound, a small quantity of liquid venous blood is effused: the edges are close, yielding, inelastic; the blood is not effused into the cellular tissue, and there are no signs of vital reaction. The presence of pus shows that the wound must have been inflicted some time before death two or three days.

*Lacerated* wounds combine the characters of incised and contused wounds. The wounds heal by suppuration.

*Punctured* wounds come intermediate between incised and lacerated. They are greater in depth than in length. They cause little hæmorrhage externally, but death may be due to internal hæmorrhage. They heal usually by suppuration.

### XXXII.—GUNSHOT WOUNDS.

These are either punctured, contused or lacerated wounds. Round balls make a larger opening than conical ones. Small shot, if fired at a little distance, make one large, ragged opening. The contents of all gunshot wounds should be preserved, as they may be useful in evidence. A gunshot, unlike a punctured

wound, becomes larger as it increases in depth. When the bullet traverses the body, two apertures will be found. The aperture of entrance is round and clean, that of exit less regular and jagged, and always *smaller* than that of entrance. (Casper.) If the weapon be fired near the body, the unburnt powder may be seen imbedded in the skin round the wound, especially if the part be first washed.

### XXXIII.—WOUNDS OF DIFFERENT PARTS OF THE BODY.

1. *Of the head.*—Wounds of the scalp are particularly likely to cause erysipelatous or diffuse inflammation. A severe blow on the vertex may cause fracture of the base of the skull. Injuries of the brain include concussion, compression, wounds, and inflammation. Concussion is a common effect of blows or violent shocks, and the symptoms follow immediately on the accident, death sometimes taking place without reaction. Compression may be caused by depressed bone or effused blood and serum. The symptoms may come on suddenly or gradually. Wounds of the brain present very great difficulties, and vary greatly in their effect: very slight wounds producing severe symptoms, and *vice versa*. A person may receive an injury to the head, recover from the first effects, and then die with all the symptoms of compression from internal hæmorrhage. The primary syncope arrests the hæmorrhage, which returns during the subsequent reaction or on the occurrence of any excitement. Inflammation may follow injuries not only to the brain itself, but to the scalp and adjacent parts, as the orbit and ear. Inflammation does not usually come on at once, but after variable periods.

2. *Injuries to the spinal cord* may be due to con-

cussion, compression, or wounds. Serious injury to the cord generally proves fatal immediately, or speedily, if in the upper part, by paralysis of the muscles of respiration. If the injury be in the lumbar or dorsal region, there is loss of power and sensation below the seat of injury, with retention of urine and escape of fæces.

3. *Of the face.*—These produce great disfigurement and inconvenience, and there is a risk of injury to the brain.

4. *Of the throat.*—Very frequently inflicted by suicides. Division of the carotid artery is fatal, and of the internal jugular vein very dangerous. Wounds of the larynx and trachea are little dangerous.

5. *Of the chest.*—Incised wounds of the walls are not very dangerous : but severe blows, by causing fracture of the bones and internal injuries, are often fatal.

6.—*Of the lungs.*—These cause hæmorrhage, and inflammation very frequently.

7. *Of the heart.*—Penetrating wounds are fatal from hæmorrhage, and of the base more speedily than of the apex ; but life may be prolonged for some time even after a severe wound to the heart.

8. *Of the aorta and pulmonary artery.*—Fatal.

9. *Of the œsophagus and thoracic duct.*—Very rare.

10. *Of the diaphragm.*—Generally dangerous from hernia of the stomach.

11. *Of the abdomen.*—Of the walls may be dangerous from division of the epigastric artery ; ventral hernia may occur, internal hæmorrhage, etc.

12. *Of the liver.*—May divide the large vessels. Wounds of the gall-bladder cause effusion of bile and peritoneal inflammation. Laceration of the liver may result from external violence without leaving any outward sign of the injury. This may also occur with other organs.



13. *Of the spleen.*—Deep wounds are fatal from hæmorrhage.

14. *Of the stomach.*—May be fatal from shock, from hæmorrhage, from extravasation of contents, or from inflammation.

15. *Of the intestines.*—May be fatal in the same way as those of the stomach. More dangerous in the small than in the large intestines.

16. *Of the kidneys.*—May prove fatal from hæmorrhage, extravasation of urine, or inflammation.

17. *Of the bladder.*—Dangerous from extravasation of urine.

18. *Of genital organs.*—Removal of penis may produce fatal hæmorrhage; if not, it is not dangerous. Removal of testicles may prove fatal from shock to nervous system. Wounds of the spermatic cord may be dangerous from hæmorrhage. Wounds to the vulva of women are very dangerous from the large plexus of veins without valves.

#### XXXIV.—DETECTION OF BLOOD-STAINS.

Stains may require detection on clothing, on cutting instruments, on floors, and furniture, etc. The following table from Dr. Aubrey Husband's "Hand-book of Forensic Medicine" gives the various distinctive characters of blood-stains.

(a) *Ocular inspection.*—Blood-stains on dark-coloured materials, which, in daylight, might be easily overlooked, may be readily detected by the use of artificial light, as that of a candle, brought near the cloth. Blood-spots, when recent, are of a bright-red colour, if arterial; of a purple hue, if venous; the latter becoming brighter on exposure to the air. After a few hours, blood-stains assume a reddish-brown tint, which they maintain for years.

(b) *Microscopic demonstration.*—With the aid of the

microscope, blood may be detected by the presence of the characteristic blood-corpuscles.

(c) *Action of water*.—Water has a wonderfully solvent action on blood, the stains rapidly dissolving when the material on which they occur is placed in cold water, a bright-red solution being formed. Rust is not soluble in water.

(d) *Action of heat*.—Blood-stains on knives, etc., may be removed by heating the metal, when the blood will peel off, at once distinguishing it from rust. Should the blood-stain on the metal be long exposed to the air, rust may be mixed with the blood, when the test will fail. The solution obtained in water is coagulated by heat, the colour entirely destroyed, and a flocculent muddy-brown precipitate formed.

(e) *Action of caustic potash*.—The solution of blood obtained in water is boiled, when a coagulum is formed soluble in hot caustic potash; the solution formed being greenish by transmitted, and red by reflected light.

(f) *Action of nitric acid*.—Nitric acid added to a watery solution produces a whitish-grey precipitate.

(g) *Action of guaiacum*.—Tincture of guaiacum produces in the watery solution a reddish-white precipitate of the resin; but on addition of an ethereal solution of peroxide of hydrogen, a blue colour is developed.

(h) *Hæmin crystals*.—These are produced by heating a drop of blood, or a watery solution of it, with glacial acetic acid in a watch-glass, and evaporating the mixture. Crystals of hæmin may be detected by the microscope in the residue. They are rhomboidal, tubular, or otherwise, of a yellowish, yellowish-red, or dirty blood-red colour. If the stain is old, salt should be added to the acetic acid solution.

(i) *Spectroscopic appearances*.—Two dark absorption bands appear, situated at the junction of the yellow

with the green rays, and in the middle of the green rays of the spectrum. The spectrum of alkanet root in solution of alum differs only from that of recent blood in having a third absorption band between the green and the blue.

There is no means of distinguishing menstrual blood from human blood the result of a wound. The blood-cells of birds are oval, those of man and the mammalia, ox, etc., are round.

### XXXV.—DEATH FROM STARVATION.

The post-mortem appearances in death from starvation are as follow : There is marked general emaciation ; the skin is dry and shrivelled ; the muscles soft, small, and free from fat ; the liver is small, but the gall-bladder is distended with bile. The heart, lungs, and internal organs are shrivelled and bloodless. The stomach is sometimes quite healthy ; in other cases it may be collapsed, empty, and with more or less ulceration of the mucous membrane. The intestines are also contracted and empty, and may be so much shrunken that the canal may be almost obliterated.

“These appearances are not so characteristic as to be decisive of the mode of death : but in the absence of any disease productive of extreme emaciation, such a state of body will furnish a strong presumption of death by starvation.”

### XXXVI.—DEATH FROM LIGHTNING.

The signs left from this mode of death vary greatly. In some cases there are no signs, in others the body may be most curiously marked. The presence or absence of a storm will help the diagnosis.

## PART II.

# TOXICOLOGY.

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### I.—DEFINITION OF A POISON.

A POISON is any substance or matter (solid, liquid, or gaseous) which, when applied to the body outwardly, or in any way introduced into it, without acting mechanically, but by its own inherent qualities, can destroy life. (Guy.)

### II.—CLASSIFICATION OF POISONS.

Various attempts have been made to devise a satisfactory system of classification, but without much success. The following is that adopted by Dr. Guy.

1. Inorganic.	{ Corrosive.	2. Organic.	{ Irritant.
	{ Irritant.		{ Affecting brain.
			{ " spinal cord.
			{ " heart.
			{ " lungs.

The most important poisons of these two classes are—*Inorganic*: arsenic, salts of lead, antimony, copper and mercury, and the mineral acids. *Organic*: opium, and its preparations, as laudanum, morphia, and Godfrey's cordial; prussic acid, oil of bitter almonds, cyanide of potassium, oxalic acid, strychnia and nuxvomica.

### III.—EVIDENCE OF POISONING.

It may be inferred that poison has been taken by a person from an examination of the following circumstances:—Symptoms and post-mortem appearances, experiments on animals, chemical analysis, and the conduct of suspected persons.

1. *Symptoms*.—In poisoning usually come on suddenly when patient is in good health, and soon after taking a meal, drink or medicine; many diseases, however, come on suddenly, and in cases of slow poisoning, the invasion of the symptoms may be gradual. 2. *Post-mortem appearances*.—These in many poisons and classes of poisons are perfectly characteristic and unmistakable. The P.M. appearances peculiar to the various poisons will be described under their respective names. 3. *Experiments on animals*.—These are valuable, but they cannot always be taken as conclusive. The dog and the cat are the animals most nearly resembling man with respect to the effects produced by poisons. 4. *Chemical analysis*.—This is, perhaps, the most important form of evidence, as a demonstration of the actual presence of a poison in the body must carry immense weight. The poison may be discovered in the living person, by testing the urine, the blood abstracted by bleeding, leeching or cupping, or the serum of a blister. In the dead body it may be found in the blood, flesh, viscera, and secretions. Its discovery in these cases must be taken as conclusive evidence of administration. If, however, it be found only in substances rejected or voided from the body, the evidence is not so conclusive, as it may be contended that the poison was introduced into the substance examined after its rejection from the body, or if the quantity be very

small it will be argued that it is not sufficient to cause death. A poison may not be found in the body, owing to defective methods, smallness of the dose required to cause death, or to its ejection by vomiting or by the secretions and excretions.

5. *Conduct of suspected persons.*—A prisoner may be proved to have purchased poison, to have made a study of the properties and effects of poison, to have made medicines or prepared food for the deceased, to have made himself the sole attendant of the deceased, to have placed obstacles in the way of obtaining proper medical assistance, to have removed substances which might have been examined, etc.

#### IV.—SYMPTOMS AND POST-MORTEM APPEARANCES OF DIFFERENT CLASSES OF POISONS.

1. *Corrosives.*—Characterized by their destructive action on parts with which they come in contact. The principal inorganic corrosives are the mineral acids, the caustic alkalies and their carbonates; the organic, carbolic acid, strong solutions of oxalic acid, and of tartaric and citric acid.

*Symptoms.*—Burning pain in mouth, throat, and gullet, strong acid, metallic, or alkaline taste, retching and vomiting, the discharged matters containing shreds of mucus, blood, and the lining membrane of the passages. Inside of mouth corroded. There is also dysphagia, thirst, dyspnoea, small and frequent pulse, anxious expression, etc.

*Post-mortem appearances.*—Those of corrosion with corrugation from strong contraction of muscular fibres, and followed by inflammation and its consequences. The mouth, gullet, and stomach, and in some cases the



intestines, are white, yellow, and brown, shrivelled and corroded. The corrosions may be small, or may extend over a very large surface. Sometimes considerable portions of the lining membrane of the gullet or stomach may be discharged by vomiting or by stool. Beyond the corroded parts the textures are acutely inflamed. The stomach is filled with a yellow, brown, or black gelatinous liquid or black blood, and may in rare cases be perforated.

2. *Irritants*.—These are substances which inflame parts to which they are applied. The class includes mineral, animal, and vegetable substances, and contains a larger number of poisons than all the other classes together. Irritants may be divided into two groups. 1. Those which destroy life by the irritation they set up in the parts to which they are applied. 2. Those which add to local irritation peculiar or specific remote effects. The first group includes the principal vegetable irritants, some alkaline salts, some metallic poisons, etc.; and the second comprises the metallic irritants, the metalloids, phosphorus and iodine, and one animal substance, cantharides.

*Symptoms*.—Burning pain and constriction in throat and gullet; pain and tenderness of stomach and bowels, intense thirst, nausea, vomiting, purging and tenesmus, with bloody stools; dysuria, cold skin and feeble and irregular pulse. Death may occur from shock, convulsions, collapse, exhaustion, or from starvation on account of the injury to the œsophagus.

*Post-mortem appearances*.—Those of inflammation and its consequences. Coats of stomach, fauces, gullet, and duodenum may be thickened, black, ulcerated, gangrenous and sloughing. Vessels filled with dark blood ramify over the surface. Acute inflammation is often found in the small intestines with ulceration and softening of mucous membrane.

3. *Poisons acting on the brain.*—Three classes ; the opium group, producing sleep ; the belladonna group, producing delirium and illusions ; and the alcohol group, causing exhilaration followed by delirium or sleep.

*Symptoms.*—Of the opium group : giddiness, headache, dimness of sight, contraction of pupil, noises in the ears, drowsiness and confusion, passing into insensibility. Of the belladonna group : delirium, spectral illusions, dilated pupils, dry mouth, thirst. Rarely there may be tetanic spasms, paralysis, etc. Of the alcohol group : excitement of circulation and of cerebral functions, want of power of co-ordination, and of muscular movement, double vision, followed by profound sleep and coma. In the chronic form, delirium tremens.

*Post-mortem appearances.* — In the opium group : fulness of the sinuses and veins of the brain, with effusion of serum into the ventricles and beneath the membranes. In the belladonna group : nil. In the alcohol group : signs of inflammation, congestion of brain and membranes, fluidity of blood, long-continued rigor mortis.

4. *Poisons acting on the spinal cord.*—Strychnia, etc. The leading symptom is tetanic spasm.

5. *Poisons affecting the heart.*—These kill by sudden shock, syncope, or collapse. They comprise, prussic acid, oxalic acid and the oxalates, aconite, digitalis, tobacco, etc.

6. *Poisons acting on the lungs.*—These have for their type, carbonic acid gas.

## V.—DUTY OF PRACTITIONER IN SUPPOSED CASE OF POISONING.

If called to a case supposed or suspected to be one of poisoning, the medical man has two duties to perform : to save the patient's life, and to assist justice. Of the preservation of life the next "Aid" will treat. If he find life extinct, his duty is only to see that justice is done. For this purpose he makes inquiries as to symptoms, time at which food or medicine was last taken, etc. He must take possession of any food, medicine, vomited matter, urine or fæces in the room, and seal them up in clean vessels for examination, and hand them over to the proper legal authorities to be dealt with as circumstances may require. He must then notice the position and temperature of the body, the condition of rigor mortis, marks of violence, appearance of gullet and mouth, and in making a post-mortem examination, the alimentary canal must be removed and preserved for further investigation. A double ligature should be passed round the œsophagus in the chest, and also round the duodenum a few inches below the pylorus. The gut and the gullet being cut across between these ligatures, the stomach may be removed entire without spilling its contents. The intestines may be removed in a similar way, and the whole or a portion of the liver should also be preserved. These should all be put in separate jars without any preservative fluid, tied up, sealed, labelled and initialed. All observations should be committed as soon as possible to writing.

## VI.—TREATMENT OF POISONING.

The modes of treatment may be ranged under three heads. 1. To get rid of the poison. 2. To stop its action. 3. To avert the tendency to death,

1. The first indication is met by the administration of emetics, to cause vomiting, or by the use of the stomach-pump. It will be seen further on in what cases respectively these two methods are admissible. Of emetics, sulphate of zinc in twenty grain doses is about the best. In narcotic poisoning sulphate of copper in eight or ten grain doses will sometimes act when other emetics have failed. Ipecacuanha wine (drachms six to eight) is sometimes useful. A teaspoonful or two of mustard in warm water frequently repeated is often an efficient substitute for the above, as is common salt occasionally. Tickling the fauces with a feather will also excite vomiting.

2. The second indication is met by the administration of an antidote. The various antidotes will be mentioned under their respective poisons.

3. To fulfil this indication we must endeavour to palliate the symptoms, and neutralize the after-effects of the poison on the constitution. In the case of narcotics and depressing agents, stimulants, galvanism, cold effusion, etc., will be desirable. Thus, injection of ammonia into the veins has been found useful by Halford and others in cases of snake bites. We must also endeavour to promote the elimination of the poison from the body by exciting the secreting functions.

## VII.—DETECTION OF POISONS.

Notice the smell, colour, and general appearance of the matter submitted for examination. The odour may show the presence of prussic acid, alcohol, opium, or phosphorus. The colour may indicate salts of copper, cantharides, etc. Seeds of plants may be found.

This examination having been made, the contents

of the alimentary canal, and any other substances to be examined, must be submitted to chemical processes. They are generally mixed, though the pure substance may sometimes be submitted to the analyst.

Simple filtration will sometimes suffice to separate the required substance; in other cases dialysis will be necessary, in order that crystalloid substances may be separated from colloid bodies. In the case of volatile substances distillation will be required. The poisons thus sought for are alcohol, phosphorus, ether, hydrocyanic acid, carbolic acid, nitro-benzol and chloroform. The organic matters are placed in a flask diluted with pure distilled water, if necessary, and acidulated with tartaric acid. The flask heated in a water bath, and the vapours condensed by a Leibig's condenser. In the case of phosphorus the condenser should be of glass, and the process of distillation conducted in the dark, so that the luminosity of the phosphorus may be noted.

For the separation of an alkaloid the following is the process of Stas. Stas' process, or rather Otto-Stas', is based upon the principle that the salts of the alkaloids are *soluble in alcohol and water*, but *insoluble in ether*, but that the pure alkaloids are, with the exception of morphia in its crystalline form, *soluble in ether*. We first, then, make a solution of the contents of the stomach or solid organs minced very fine, by digesting them with acidulated alcohol or water and filtering. The filtrate is shaken with ether to remove fat, etc., the ether separated, the watery solution neutralized with soda, and then shaken with ether, which removes the alkaloid in a more or less impure condition. The knowledge of these facts will help to explain the following details of the process, which may be modified to suit individual cases: 1. Treat the organic matter, after distillation for the volatile sub-

stances just mentioned, with twice its weight of absolute alcohol, free from fusel oil, to which from ten to thirty grains of tartaric or oxalic acid have been added, and subject to a gentle heat. 2. Cool the mixture and filter ; wash the residue with strong alcohol and mix the filtrates. *The residue may be set aside for the detection of the metallic poisons, if suspected.* Expel the alcohol by careful evaporation. On the evaporation of the alcohol the resinous and fatty matters separate. Filter through a filter moistened with water. Evaporate the filtrate to a syrup, and extract with successive portions of absolute alcohol. Filter through a filter moistened with alcohol. Evaporate filtrate to dryness, and dissolve residue in water, the solution being made distinctly acid. Now shake watery solution with ether. 3. Ether from the acid solution dissolves out *colchicin*, *digitalin*, *cantharidin*, and *picrotoxin*, and traces of *veratria* and *atropia*. Separate the ethereal solution and evaporate. Hot water will now dissolve out *picrotoxin*, *colchicin*, and *digitalin*, but not *cantharidin*. 3. The remaining acid watery liquid, holding the other alkaloids in solution or suspension, is made strongly alkaline with soda mixed with four or five times its bulk of ether, chloroform, or benzole, briskly shaken, and left to rest. The ether floats on the surface, holding the alkaloid, except morphia, in solution. 4. A part of this ethereal solution is poured into a watch-glass and allowed to evaporate. If the alkaloid be volatile, oily streaks will appear on the glass ; if not volatile, some crystalline traces will be visible. If a volatile alkaloid, add a few pieces of calcium chloride to ethereal solution, to absorb the water ; draw off the ethereal solution with a pipette and allow it to evaporate, and test the residue for the alkaloids, conia and nicotin.

If a fixed alkaloid, treat the acid solution with soda



or potash and ether, evaporate ethereal solution after separation, when the solid alkaloid will be left in an impure state. To purify it, add a small quantity of dilute sulphuric acid, and after evaporating to  $\frac{3}{4}$  of its bulk add a saturated solution of carbonate of potash or soda. Absolute alcohol will then dissolve out the alkaloid and leave it on evaporation in a crystalline form.

In order to isolate an inorganic substance from organic matter, Fresenius' method is adopted. Boil the finely divided substance with about  $\frac{1}{8}$  its bulk of pure hydrochloric acid; add from time to time potassic chlorate, until the solids are reduced to a straw-yellow fluid. Treat this with excess of bisulphate of soda, then saturate with sulphuretted hydrogen until metals are thrown down as sulphides. These may be collected and tested. From the acid solution hydrogen sulphide precipitates copper, lead and mercury, *dark*; arsenic, antimony and tin, *yellowish*. If no precipitate, add ammonia and ammonium sulphide, iron, *black*, zinc, *white*, chromium, *green*, manganese, *pink*. The residue of the material after digestion with hydrochloric acid and potassium chlorate may have to be examined for silver, lead and barium.

For the detection of minute quantities the microscope must be used, and Guy's and Helwig's method of sublimation will be found very advantageous. Crystalline poisons may be recognised by their characteristic forms.

## VIII.—THE MINERAL ACIDS.

These are Sulphuric, Nitric, and Hydrochloric acids.

*Symptoms* of poisoning by the mineral acids.—Sour taste in the mouth, with violent burning pain extending into the œsophagus and stomach, and commencing

immediately on the poison being swallowed ; eructations, constant retching, and vomiting of brownish and blackish matter containing blood, coagulated mucus, epithelium, or portions of the lining membrane of the gullet and stomach. There is constipation, scanty or suppressed urine, tenesmus, small and frequent pulse; the lips, tongue, and inside of the mouth are shrivelled and corroded. Exhaustion succeeds, and the patient dies either collapsed, convulsed, or suffocated, the intellect remaining clear to the last. In chronic poisoning by the mineral acids there is fever, dry skin, frequent pulse, vomiting of food mixed with flakes of false membrane or of lining membrane of gullet and stomach, salivation, tenseness of abdomen, short and difficult breathing, impaired digestion, emaciation. After recovery from the acute form of poisoning the patient may ultimately die from starvation due to stricture of the œsophagus, stomach, etc.

*Post-mortem appearances* common to the mineral acids.—Stains and corrosions about the mouth, chin, fingers, etc., wherever the acid has come in contact. The inside of the mouth, fauces and œsophagus is white and corroded or dark-brown and shrivelled. Epiglottis contracted or swollen. Stomach distended with gas and filled with brown, yellow, or black glutinous liquid ; its lining membrane is charred or inflamed, and the vessels injected. Pylorus contracted. Perforation, when it takes place, is posterior, the apertures are circular, and surrounded by inflammation and black extravasation. The blood in the large vessels may be coagulated.

*Treatment*.—Calcined magnesia, or the carbonate or bicarbonate of soda, mixed with milk or some mucilaginous liquid, are the best antidotes. In the absence of these, chalk, whiting, plaster from a ceiling, milk, oil, soap-suds, etc., will be found of service. The

stomach-pump should *not* be used. If the acid have got into the larynx and impede the breathing, tracheotomy may be necessary. Injuries of external parts by the acid must be treated as burns.

## IX.—SULPHURIC ACID.

SULPHURIC ACID, or oil of vitriol, is met with concentrated or diluted. Besides its use as an internal poison it is frequently thrown over the person to disfigure the features or destroy the clothes. Parts of the body touched by it are stained, first white, and then dark brown or black. The presence of corrosion of the mouth is as important as the chemical tests. Black woollen cloths it turns to a dirty brown, the edges of the spots becoming red in a few days, due to the dilution of the acid from the absorption of moisture.

*Method of extraction from the stomach, etc.*—The contents of the stomach or vomited matters should, if necessary, be diluted with pure distilled water and filtered. The *coats* of the stomach cut up in small pieces and boiled for some time in water. The solution, filtered and concentrated, is now ready for testing. Blood, milk, etc., may be separated by dialysis and the fluid so obtained tested. A sulphate may be present. Take a portion of the liquid, evaporate to dryness, and incinerate; a sulphate, if present, will be obtained and may be tested. *Caution.*—Sulphuric acid may *not be found* even after large doses, due to treatment, vomiting, or survival for several days. In all cases every organ, etc., should be examined. Vomited matters and contents of stomach should not be mixed, but each *separately* examined. This rule holds good for *all* poisons. On *cloth* the stain may be cut out, boiled in water, the solution filtered, and tested with blue blitmus and other tests.

*Tests.*—Concentrated acid chars organic matter; evolves heat when added to water, and sulphurous fumes when boiled with chips of wood, copper cuttings, or mercury. Dilute acid chars paper; when the paper is heated, gives a white precipitate with nitrate or chloride of barium; and is entirely volatilized by heat.

*Symptoms, p.-m. appearances, and treatment.*—Aid viii.

*Fatal dose.*—In an adult, one drachm.

*Fatal period.*—(*Shortest.*) One hour.

## X.—NITRIC ACID.

NITRIC ACID, aqua fortis, or red spirit of nitre, is not so much used as a poison as sulphuric. The fumes from nitric acid have caused death from pneumonia in ten or twelve hours.

*Method of extraction from the stomach, etc.*—The same as for sulphuric acid. Aid ix. In beer, etc., the mixture may be neutralized with carbonate of potash, dialysed, the fluid concentrated and allowed to crystallize, when the crystals of nitrate of potash may be examined.

*Tests.*—Concentrated acid gives off irritating orange-coloured fumes (nitrous acid gas). When poured on copper it gives off red fumes, and leaves a green solution of nitrate of copper. It strikes a red colour with brucia, turns green sulphate of iron black, and with hydrochloric acid dissolves gold. A delicate test for the acid free, or in combination, is to dissolve in the suspected fluid some crystals of ferrous sulphate, and then to gently pour down the test tube some strong sulphuric acid. Where the two liquids meet, if nitric acid be present, a reddish-brown ring will be formed. The skin it turns bright yellow, and does the same with woollen clothes, due to the formation of *picric acid*.

*Symptoms, p.-m. appearances, and treatment.*—Aid viii.

*Fatal dose.*—Two drachms.

*Fatal period.*—(*Shortest.*) One hour and three quarters in an adult.

## XI.—HYDROCHLORIC ACID.

HYDROCHLORIC ACID, muriatic acid, or spirit of salt, is not often employed as a poison.

*Method of extraction from the stomach, etc.*—The same as for sulphuric acid. Aid ix. As hydrochloric acid is a constituent of the gastric juice, the signs of the acid must be looked for.

*Tests.*—Concentrated acid fumes in moist air, and yields dense white vapours with ammonia. When boiled with black oxide of manganese it gives off chlorine, recognised by its smell and bleaching properties. Diluted it gives a white precipitate with nitrate of silver, which is insoluble in nitric acid and in caustic potash, but is soluble in ammonia, and when dried and heated melts, and forms a horny mass.

*Symptoms, p.-m. appearances, and treatment.*—Aid viii.

*Fatal dose.*—Half an ounce.

*Fatal period.*—(*Shortest.*) Five hours and a half.

Nitric and sulphuric acids, mixed, form aqua reginæ, used to dissolve silver; and nitric and hydrochloric acids mixed form aqua regia, used to dissolve gold and platinum.

## XII.—ALKALIES.

It is rare to find cases of poisoning by the alkalies. They possess the property, like the mineral acids, of destroying animal tissues with which they come in contact. No specific remote effects are produced.

## XIII.—POTASH.

POTASH occurs usually as caustic potash, liquor potassæ, carbonate, bicarbonate, or salt of tartar (potashes and pearlash).

CAUSTIC POTASH occurs in cylindrical sticks, is soapy to the touch, has an acrid taste, is deliquescent, fusible by heat, soluble in water.

LIQUOR POTASSÆ is a strong solution of the above with a like reaction.

CARBONATE OF POTASH, *bicarbonate of potash*, or *salt of tartar*, occurs in two forms. 1. A mottled, deliquescent, grey, yellow, or brown mass, strongly alkaline; this is called *potash* or *potashes*. 2. In small grains or a white semi-crystalline mass: *pearlash*.

*Symptoms*.—Acrid taste in mouth, burning in throat and gullet, acute pains at pit of stomach, vomiting of bloody mucus, colicky pains, bloody stools, surface cold, pulse weak. In chronic cases death occurs from stricture of the œsophagus, causing starvation.

*Post-mortem appearances*.—Softening, inflammation and corrosion of mucous membrane of mouth, pharynx, œsophagus, stomach and intestines. Inflammation may have extended to larynx.

*Method of extraction from the stomach, etc.*—If the contents of the stomach have a strong alkaline action, dilute with water, filter, and apply tests.

*Tests*.—The carbonates effervesce with an acid. The salts give a yellow precipitate with platinum chloride, and a white precipitate with tartaric acid. They are not dissipated by heat, and give a violet colour to the deoxidizing flame of the blow pipe.

*Treatment*.—Vinegar and water, lemon-juice and water, acidulated stimulant drinks, oil, linseed tea, etc., opium to relieve pain, stimulants in collapse. *Not stomach-pump*.



*Fatal dose.*—Half an ounce.

*Fatal period.*—(*Shortest.*) Three hours.

#### XIV.—SODA.

CARBONATE OF SODA occurs as *soda* and *best soda*, the former in dirty crystalline masses, the latter of a purer white colour.

*Symptoms, post-mortem appearances, and treatment*, as for potash.

*Method of extraction from the stomach, etc.*, as for potash.

*Tests.*—Alkaline reaction, effervesces and evolves carbonic acid when treated with an acid; crystallizes, gives yellow tinge to blowpipe flame. No precipitate with tartaric acid, nor with bichloride of platinum.

#### XV.—AMMONIA.

AMMONIA may be taken as *Liquor ammoniæ*, or as *carbonate of ammonia* (hartshorn).

*Symptoms.*—Being very volatile, it attacks the air-passages, and may cause death from inflammation of the larynx and lungs. When swallowed in solution, the symptoms are similar to those of soda and potash.

*Post-mortem appearances.*—Similar to other corrosives.

*Method of extraction from the stomach, etc.*—The contents of the stomach, etc., must be first distilled, the gas being conveyed into water *free* from ammonia.

*Tests.*—Nessler's reagent is the most delicate, but ammonia may be recognised by its pungent odour, dense fumes given off with hydrochloric acid, and strong alkaline reaction.

*Treatment.*—Vinegar and water. Other treatment according to symptoms.

*Fatal dose.*—One drachm of strong solution.

*Fatal Period.*—(*Shortest.*) Four minutes.

## XVI.—IRRITANTS. SALTS OF THE ALKALIES AND EARTHS.

The carbonates of ammonia, potash and soda have been treated of already. Iodide of potassium will be discussed under the heading of iodine, and binoxalate of potash under oxalic acid.

## XVII.—NITRATE, SULPHATE, AND BITARTRATE OF POTASH.

NITRATE OF POTASH (nitre, sal prunella), occurs in crystals, or cakes or balls (prunella balls). It is easily procured, and is probably a more common poison among children than is generally supposed.

*Symptoms.*—Irritation of alimentary canal, vomiting and diarrhoea, pain at pit of stomach, trembling of limbs, collapse.

*Post-mortem appearances* include marks of acute inflammation in stomach and intestines.

*Method of extraction from the stomach, etc.*—Dialysis, and this may be adopted for all the poisons in this and the next four aids. The tests are those for potash and its salts.

*Tests.*—As for nitric acid.

*Treatment.* — Emetics, stomach - pump, stimulant drinks, ice.

*Fatal dose.*—One ounce.

SULPHATE OF POTASH.—(Sal polychrest, sal de duobus.)

*Symptoms and post-mortem appearances*, as other irritant poisons.

*Treatment.*—As for nitrate of potash.

**BITARTRATE OF POTASH.**—(Argol, cream of tartar.) Has caused death in one case. *Symptoms*, those of an irritant poison with paralysis of lower extremities.

*Treatment.*—As for nitrate.

*Fatal dose.*—Two ounces.

## XVIII.—ALUM, SULPHURET OF POTASSIUM.

**ALUM.**—(Sulphate of alumina and ammonia.) This is not often taken as a poison. It occurs in crystalline masses, or white powder.

*Symptoms and treatment*, as other irritant poisons.

**SULPHURET OF POTASSIUM.**—(Liver of sulphur.) Occurs in mass or powder of a dirty-green colour. Gives a yellow solution, and has a strong smell of sulphuretted hydrogen. The addition of acid liberates the gas, which may be detected by the usual tests.

*Symptoms.*—Of acute irritant poisoning, with stupor or convulsions. Excreta smell of sulphuretted hydrogen.

*Post-mortem appearances.*—Stomach and duodenum reddened, with deposit of sulphur. Lungs gorged.

*Treatment.*—Chloride of soda or lime in dilute solution, and ordinary treatment for irritant poisoning.

*Fatal period.*—(*Shortest.*) Fifteen minutes.

## XIX.—CHLORIDE OF SODIUM.

**CHLORIDE OF SODIUM.**—(Common salt.)

*Tests.*—For the hydrochloric acid, nitrate of silver, which gives a white precipitate of argentic chloride; for the base, bichloride of platinum, which has a negative reaction.

*Symptoms.*—As of irritant poisoning generally.

*Treatment.*—As for nitrate of potash. Aid xvii.

## XX.—CHLORIDES OF LIME, SODA, AND POTASH.

These substances, used as bleaching powders and liquids, are all poisonous. They give off chlorine on the addition of an acid, smell strongly of that substance, and have powerful bleaching properties. The *symptoms*, etc., are the same as those of other irritants.

## XXI.—BARIUM SALTS.

CHLORIDE OF BARIUM occurs crystallized in irregular plates, soluble in water and bitter in taste.

CARBONATE OF BARIUM is found native in massive radiated crystals, heavy and nearly colourless. It is found in shops as a fine powder, tasteless and colourless, insoluble in water, but effervescing with dilute acids, and readily decomposed by the free acids of the stomach.

NITRATE OF BARIUM occurs in octahedral crystals. Soluble in water.

*Method of extraction from the stomach, etc.*—Dialysis as for other soluble poisons.

*Tests.*—Precipitated from its solutions by potassium carbonate and sulphuric acid. Burnt on platinum foil it gives a greenish-yellow colour to the flame.

*Symptoms.*—Besides those of irritants generally, violent cramps and convulsions, headache, debility, dimness of sight, double vision, noises in the ears, and beating at the heart. The salts of barium are also cardiac poisons.

*Post-mortem appearance.*—As of irritants generally. Stomach may be perforated.

*Treatment.*—Sulphate of soda or magnesia, emetics, and the stomach-pump. Other treatment as for irritants.

## XXII.—IRRITANT GASES.

These are, 1. Nitrous acid gas (see Aid x.). 2. Sulphurous acid gas. 3. Hydrochloric acid gas. 4. Chlorine. 5. Ammonia (Aid xv.). They have the common property of causing irritation and inflammation of the eyes, throat, and air-passages, and may cause spasm of glottis.

**SULPHUROUS ACID GAS:** one of the products of combustion of common coal. Bleaching and antiseptic.

**HYDROCHLORIC ACID GAS.**—Irrespirable when concentrated, and very irritating when diluted. Very destructive to vegetable life.

**CHLORINE.**—Used in bleaching, and as a disinfectant. Greenish-yellow colour, suffocating odour. In poisoning, inhalation of sulphuretted hydrogen gives relief.

## XXIII.—PHOSPHORUS.

**PHOSPHORUS** occurs usually in small waxy cylinders. It may also occur as the amorphous non-poisonous variety, a red opaque, infusible substance, insoluble in carbon-disulphide. Ordinary phosphorus is soluble in oil, alcohol, ether, chloroform, and carbon-disulphide; insoluble in water. Much used in rat-poisons, made into a paste with flour, sugar, fat, and Prussian-blue. Also used for the tops of lucifer-matches. In "safety-matches" the amorphous phosphorus is on the box.

*Symptoms.*—At first those of irritant poisons, but days may elapse before any characteristic symptoms appear, and these may be mistaken for those of acute yellow atrophy of the liver. Then vomiting of matters luminous in the dark, bilious or bloody, with garlic-

like odour. Great prostration, diarrhoea with bloody stools. Then harsh, dry, yellow skin, erythematous spots, retention or suppression of urine, delirium, convulsions, coma, and death. In chronic cases there is frequently caries of the lower jaw.

*Post-mortem appearances.*—Softening of the stomach, bloody spots on all organs, fatty degeneration of liver, kidneys, and heart, bloody urine, yellow skin, phosphorescent contents of alimentary canal.

*Treatment.*—Early use of stomach-pump and emetics, followed by the administration of the *crude French oil* of turpentine. Oil should not be given. Sulphate and carbonate of magnesia; mucilaginous drinks, etc. Sulphate of copper is a most valuable antidote, both as an emetic and as forming an insoluble compound with phosphorus.

*Fatal dose.*—One grain and a half.

*Fatal period.*—(*Shortest.*) Four hours.

*Detection of Phosphorus in organic mixtures.*—Mitscherlich's method is the best. Introduce the suspected material into a retort. Acidulate with sulphuric acid to fix any ammonia present. Distil in the dark, through a glass tube kept cool by a stream of water. As the vapour passes over and condenses, a flash of light is perceived, which is the test.

## XXIV.—IODINE AND IODIDE OF POTASSIUM.

IODINE occurs in scales of a dark bluish-black colour. It strikes blue with solution of starch, and stains the skin and intestines yellowish-brown.

*Symptoms.*—Acrid taste, tightness of throat, epigastric pain, and then symptoms of irritant poisons generally. Chronic poison (iodism) produces irritation of alimentary canal, ptyalism, coryza, enlargement and tenderness of the liver.



*Post-mortem appearances.*—Those of irritant poisoning with corrosion.

*Treatment.*—Stomach-pump and emetics, carbonate of soda, amylaceous fluids, gruel, arrowroot, starch, etc.

*Analysis of organic mixture containing Iodine.*—Add bisulphide of carbon, and shake. The iodine may be obtained on evaporation as a sublimate. It will be recognised by the blue colour which it gives with starch.

**IODIDE OF POTASSIUM.**—Much used in medicine. A white crystalline substance. Peculiar odour. Very slightly deliquescent.

*Symptoms.*—Small doses have sometimes produced serious effects. Vomiting and purging, griping abdominal pains, coryza, swelling of face, headache, dryness of throat, thirst. In less marked cases, symptoms of a common cold.

*Treatment.*—Emetics, stomach-pump, starch, etc.

*Analysis.*—Iodide of potassium in solution gives a bright yellow precipitate with a lead salt; a bright scarlet one with corrosive sublimate; and a blue colour with sulphuric or nitric acid and starch. In organic mixtures a current of hydrosulphuric acid gas should be passed through: this changes the free iodine into hydriodic acid. Drive off excess of gas, add potash in excess, filter and evaporate. Char the residue at low red heat, in a closed crucible, powder the charred mass, treat with distilled water, and filter; evaporate and apply acid and starch.

## XXV.—ARSENIC AND ITS PREPARATIONS.

**ARSENIC** is the most important of all the metallic poisons. It is much used in medicine and the arts. It occurs as metallic arsenic, which is of a steel-grey colour, brittle, and giving off a garlic-like odour when

heated; as arsenious acid; in the form of two sulphides, the red sulphide, or realgar, and the yellow sulphide, or orpiment; and as arsenite of copper, or Scheele's green. It also exists as an impurity in the ores of several metals—iron, copper, silver, tin, zinc, nickel, and cobalt. Sulphuric acid is frequently impregnated with arsenic from the iron pyrites used in preparing the acid.

*Arsenious Acid*.—(White arsenic, oxide of arsenic, etc.) Colourless, odourless, and almost tasteless. It occurs in commerce as a white powder and in a solid cake, which is at first translucent, but afterwards becomes opaque. Slightly soluble in cold water: an ounce of water dissolves about half a grain of arsenic. Fowler's solution or *ague drop* is the best known medicinal preparation of arsenic, and contains  $\frac{1}{24}$  of a grain in five minims of the solution. The law requires that arsenic, when sold in quantities under ten pounds, shall be mixed with soot or indigo.

*Symptoms*.—Commence in about half-an-hour. Faintness, nausea, incessant vomiting, epigastric pain, headache, diarrhœa, tightness and heat of throat and fauces, thirst, catching in the breath, restlessness, debility, cramp in the legs and convulsive twitchings. The skin becomes cold and clammy. In some cases the symptoms are those of collapse, with but little pain, vomiting or diarrhœa. In others the patient falls into a deep sleep, while in a fourth class the symptoms resemble closely those of English cholera. Arsenical poisoning has been mistaken for scarlet fever and nettle-rash. The vomited matters are often blue, black, or greenish from bile, with the soot or indigo mixed with the poison. Should the patient survive for sixteen days, no trace of arsenic may be found in the body, as the poison is rapidly eliminated by the kidneys; hence in all suspected cases the urine should be first examined.

The symptoms of *chronic* poisoning by arsenic are : loss of appetite, silvery tongue, thirst, nausea, colicky pains, diarrhoea, headache, languor, sleeplessness, cutaneous eruptions, soreness of the edges of the eyelids, emaciation, anæmia and convulsions.

*Post-mortem appearances.*—Signs of acute inflammation of stomach, duodenum, small intestines, and colon. Stomach may contain dark grumous fluid, and its mucous coat present the appearance of crimson velvet. Ulceration is *rare*, and cases of perforation *very* doubtful, the patient dying before it occurs. There may be entire absence of *post-mortem* signs. Putrefaction of the body is much retarded by arsenic.

*Treatment.*—The stomach-pump, emetics, then milk, milk and eggs, oil and lime-water, etc. Inflammatory symptoms, collapse, coma, etc., must be treated on ordinary principles. As an antidote, the best when the poison is in solution is the hydrated peroxide of iron, formed by precipitating tinctura ferri perchloridi with excess of ammonia. Dialysed iron has also been found efficacious.

*Fatal dose.*—(*Smallest.*) Two grains.

*Fatal period.*—(*Shortest.*) Twenty minutes. The effects of arsenic depend much on idiosyncrasy, some persons being able to take considerable quantities. The peasants of Styria are in the habit of eating it.

*Method of extraction from the stomach, etc.*—The coats of the stomach should first be examined with a lens for any white particles. These, if present, may be collected, mixed with a little black flux in a test-tube and heated. If arsenic is present a metallic ring will be formed in the cooler parts of the tube ; if this ring be also heated, octahedral crystals of arsenic will be deposited further up the tube. The contents of the stomach, or the solid organs minced up, should be boiled with pure hydrochloric acid and water ; then

filtered. The filtrate can then be subjected to Marsh's or Reinsch's process. The organic matter may be destroyed by the method of Frensius before given. Aid vii.

*Tests.*—Arsenious acid heated on platinum foil sublimes unchanged as a white smoke.

In *solution*, arsenic may be detected by the liquid tests. 1. Ammonio-nitrate of silver gives a yellow precipitate (arsenite of silver). 2. Ammonio-sulphate of copper gives a green precipitate (Scheele's green). 3. Sulphuretted hydrogen water gives a yellow precipitate.

*Marsh's Process.*—Put some pure distilled water into a Marsh's apparatus with metallic zinc and sulphuric acid. Hydrogen is thus set free, and should be tested by lighting the issuing gas and depressing over it a piece of white porcelain. If no mark appears, the re-agents are pure, and the suspected liquid may now be added. The hydrogen decomposes arsenious acid, and forms arseniuretted hydrogen. The gas carried off by a fine tube is again ignited. A piece of glass or porcelain held to the flame will have, if arsenic be present, a deposit on it, having the following characters. In the centre a deposit of metallic arsenic, round this a mixture of metallic arsenic and arsenious acid, and outside this another ring of arsenious acid in octahedral crystals. The deposit is dissolved by a solution of chloride of lime, turned yellow by sulphide of ammonium after evaporation; on the addition of strong nitric acid, evaporated and neutralized with ammonia and nitrate of silver added, a brick-red colour is produced—arsenate of silver.

*Reinsch's Process.*—Boil distilled water with one-sixth or one-eighth of hydrochloric acid, and introduce a slip of bright copper. If after a quarter of an hour's boiling there is no stain on the copper, add

the suspected liquid. If arsenic be present, it will form an iron-grey deposit. This can be obtained pure by reduction.

*Other preparations of Arsenic.*—These are : arsenite of potash (Fowler's solution), and arsenite of copper (Scheele's green), the latter frequently used for colouring dresses and wall-papers. Persons using it suffer from catarrhal symptoms, rashes on the neck, ears and face, thirst, nausea, pain in stomach, vomiting, headache, etc. The arsenites give the reactions of arsenious acid.

## XXVI.—ANTIMONY AND ITS PREPARATIONS.

Two preparations of antimony are used as poisons, viz. : Tartar emetic and chloride of antimony.

**TARTAR EMETIC.**—(Tartarised antimony, potassio-tartrate of antimony.) Occurs as a white powder, or in yellowish-white efflorescent crystals. Vinum antimoniae contains two grains to an ounce of wine.

*Symptoms.*—Metallic taste, rapidly followed by nausea, vomiting, burning heat and pain in stomach, purging. Dysphagia, sense of constriction in throat, intense thirst, cramps ; in fatal cases, giddiness and tetanic spasms. In chronic poisoning, nausea, vomiting and purging, weak pulse, loss of appetite, debility, cold sweats. The symptoms in chronic poisoning may simulate gastritis or enteritis. Externally applied, it produces an eruption not unlike that of *small-pox*.

*Post-mortem appearances.*—Inflammation, softening, and an aphthous condition of the throat, gullet, and stomach, the last reddened in patches. In chronic poisoning, inflammation also of cæcum and colon. Brain and lungs may be congested.

*Treatment.*—Promote vomiting by warm greasy water ; or the stomach-pump may be used. Cinchona



bark is the best antidote, and next to it, liquids containing tannin : as tea, decoction of oak bark, etc.

*Fatal dose.*—In an adult, two grains.

*Fatal period.*—From a few hours to some weeks.

*Method of extraction from the stomach, etc.*—The contents of the stomach or its coats should be finely cut up and boiled in water, acidulated with tartaric acid and subjected to dialysis, or strained and filtered. Pass hydrogen sulphide through the filtered or dialysed fluid until a precipitate ceases to fall ; collect the sulphide thus formed, wash and dry it. Boil the orange-coloured sulphide in a little hydrochloric acid. If the solution be now added to a large bulk of water the white oxychloride is precipitated, which is soluble in tartaric acid and precipitated orange yellow with hydrogen sulphide. The chloride of bismuth is also precipitated white, but the precipitate is not soluble in tartaric acid, and the precipitate with hydrogen sulphide is black.

*Tests.*—Soluble in water, but not in alcohol.

Heated in substance, it crepitates and chars ; and if heat be increased, the metal is deposited. Treated with sulphuretted hydrogen, a characteristic orange-red sulphide is formed.

A drop of the solution, evaporated, leaves crystals, either tetrahedric or cubes with edges bevelled off. Sulphuretted hydrogen passed through gives the orange-red precipitate above named. *Dilute nitric acid* gives a white precipitate, soluble in excess, and also in tartaric acid. Marsh's and Reinsch's processes are applicable for the detection of antimony, but Reinsch's is the better of the two (see Aid xxv.). Reinsch's process gives a violet deposit instead of the black lustrous one of arsenic.

CHLORIDE OF ANTIMONY.—(Butter of antimony.)  
A light-yellow or dark-red corrosive liquid.



*Symptoms.*—Violent corrosion and irritation of the alimentary canal, with the addition of narcotic symptoms. After death the mucous membrane of the entire canal is charred, softened and abraded.

*Treatment.*—As for tartar emetic; magnesia in milk.

## XXVII.—MERCURY AND ITS PREPARATIONS.

The most important preparation of mercury, toxicologically speaking, is corrosive sublimate. Others are: calomel; ammonio-chloride; red precipitate, sulphide, cinnabar or vermilion; subsulphate of oxide or turpeth mineral; cyanide, and the two nitrates. Metallic mercury is not poisonous, but its vapour is very so.

CORROSIVE SUBLIMATE (oxymuriate or perchloride of mercury) occurs as imperfect crystalline masses or as a white powder. Nauseous corrosive taste, soluble in 16 parts of cold, and 3 of boiling water. Soluble in alcohol and ether; the latter also separating it from its solution in water.

*Symptoms.*—Come on rapidly. Acrid metallic taste, constriction and burning in throat and stomach, nausea, vomiting of stringy mucus tinged with blood, purging. Feeble, quick, and irregular pulse. Cramp, twitches, and convulsions of limbs, occasionally paralysis. There may be salivation, marked by a coppery taste, peculiar foetor of breath, tenderness and swelling of mouth, inflammation, swelling and ulceration of gums (cancrum oris), flow of saliva, loosening of teeth, etc. Mercury is not so quickly eliminated from the body as arsenic.

*Post-mortem appearances.*—Corrosion, softening, and sloughing ulceration of stomach and intestines. Inflamed condition of urinary organs, with contraction of the bladder.

*Treatment.*—Encourage or produce vomiting. Albumen, as white of egg, gluten or wheat flour, is the best antidote. Demulcent drinks, milk and ice.

Stomach-pump to be avoided if possible, owing to softened state of gullet and stomach.

*Fatal dose.*—Three grains in a child.

*Fatal period.*—Half an hour the shortest.

*Method of extraction from the stomach, etc.*—A trial test may be made in the contents of the stomach with copper foil. If mercury is found, the contents of the stomach may be dialysed, the resulting clear fluid concentrated and shaken with ether, which has the power of taking corrosive sublimate up and thus separating it from arsenic and other metallic poisons. The ether allowed to evaporate will leave the corrosive sublimate in white silky-looking prisms. Suppose no mercury is found in the dialysed fluid, owing to the fact that corrosive sublimate enters into insoluble compounds with albumen, fibrin, mucous membrane, gluten, tannic acid, etc., we must dry the insoluble matter, and heat it with nitro-hydrochloric acid until all organic matter is destroyed and excess of nitric acid expelled. The residue dissolved in water, filtered, and tested with copper foil, etc.

*Tests.*—The following table, from Dr. Husband's handbook, shows the action of corrosive sublimate with reagents.

1. With iodide of potassium.....Bright scarlet colour.
2. With potash solution .....Bright yellow colour.
3. With hydrosulphuret of ammonia .....First a yellowish and then a black colour.
4. Heated in a reduction tube...Melts, boils, is volatilised, and forms a white crystalline sublimate.
5. With ether .....Freely soluble; the ethereal solution, when allowed to evaporate spontaneously, deposits the salt in white prismatic crystals.
6. Heated with carbonate of soda in a reduction tube.....Globules of metallic mercury are produced.

A very simple process for detecting corrosive sublimate is to put a drop of the suspected solution on a sovereign and touch the gold through the solution with a key, when metallic mercury will be deposited on the gold.

## XXVIII.—LEAD AND ITS PREPARATIONS.

The chief salts of lead producing poisonous effects are the acetate, subacetate, and carbonate.

**ACETATE OF LEAD.**—(Sugar of lead.) A glistening white powder or crystalline mass. Soluble in water, sweetish taste.

**SUBACETATE OF LEAD.**—(Goulard's extract.) A whitish liquid. May be reddish, due to the vinegar with which it is prepared.

**CARBONATE OF LEAD.**—(White lead, ceruse.) Heavy white masses, like chalk. Very insoluble in water. Easily acted on by acids.

*Symptoms.*—Metallic taste, dryness in throat, intense thirst, vomiting, colicky pains, cramps, cold sweat, constipation, scanty urine, and blue line on gums.

In chronic lead-poisoning the most prominent symptoms are a blue line on the gums, emaciation, pallor, quick pulse, constipation, colic, and paralysis of the extensors, causing "dropped hand."

*Post-mortem appearances.*—Inflamed mucous membrane of stomach and intestines, with layers of white or whitish-yellow mucus, impregnated with the salt of lead.

*Treatment.*—Sulphate of soda or magnesia. Milk, or milk and eggs. Emetics.—Iodide of potassium and galvanic baths, in chronic poisoning. As a prophylactic among workers in lead a drink containing sul-

phuric acid should be given. Scrupulous cleanliness should also be enjoined in the workshops.

*Fatal dose and fatal period.*—Uncertain.

*Method of extraction from the stomach, etc.*—Dry the contents of the stomach or portions of the liver, etc., and incinerate in a *porcelain* crucible. Treat the ash with nitric acid, dry and dissolve in water. The solution of nitrate of lead may now have the proper tests applied.

*Tests.*—Sulphuretted hydrogen gives a black precipitate; liquor potassæ, white precipitate; sulphuric acid, white precipitate, insoluble in nitric acid; iodide of potassium, a bright yellow precipitate. A very delicate test for lead in water is to stir the water, concentrated or not, with a glass rod dipped in ammonium sulphide: a brown colouration is produced. The one-tenth of a grain of lead in a gallon of water may be thus detected.

## XXIX.—COPPER AND ITS PREPARATIONS.

Poisoning with copper salts is very rare. The most important are sulphate, subacetate, and arsenite.

**SULPHATE OF COPPER.**—(Bluestone, blue vitriol.) In half-ounce doses is a powerful irritant. Has been given to procure abortion.

**SUBACETATE OF COPPER.**—(Verdigris.) Occurs in masses, or as a greenish powder. Powerful, astringent, metallic taste. Half-ounce doses have proved fatal.

**ARSENITE OF COPPER.**—(See Arsenic.)

*Symptoms.*—Epigastric pain, vomiting of bluish or greenish matter, diarrhœa. Dyspnœa, depression, cold extremities, headache, purple line round the gums. The urine passed by workers in copper is said to be bluish-green, yet the workers do not appear to be

injuriously affected by absorption of the metal. Jaundice is common.

*Post-mortem appearances.*—Inflammation of stomach and intestines, which are green in colour.

*Treatment.*—Encourage vomiting. Give albumen.

*Method of extraction from the stomach, etc.*—Boil the contents of the stomach in water, filter, pass hydrogen sulphide, filter, collect precipitate and boil in nitric acid, filter, dilute filtrate with water and apply tests. In the case of the solid organs, dry, incinerate, digest ash in hydrochloric acid, evaporate nearly to dryness, dilute with water, and test.

*Tests.*—Polished steel put into a solution containing a copper salt receives a coating of metallic copper. Ammonia gives a blue precipitate, soluble in excess. Ferrocyanide of potassium gives a rich red-brown precipitate. Sulphuretted hydrogen gives a deep-brown precipitate.

### XXX.—ZINC, TIN, SILVER, IRON, BISMUTH, AND CHROME.

The preparations of zinc requiring notice are: sulphate and chloride.

SULPHATE OF ZINC in large doses causes dryness of throat, thirst, vomiting, purging and abdominal pain.

*Post-mortem appearances.*—Those of inflammation of digestive tract.

*Treatment.*—Tea, decoction of oak-bark, carbonate of potash or soda as antidote.

CHLORIDE OF ZINC.—A solution containing this substance (200 grains to the ounce) constitutes "Burnett's disinfecting fluid." It is a corrosive poison.

*Method of extraction from the stomach, etc.*—Dry and incinerate the tissues in a porcelain crucible; digest ash in water. Apply tests.



*Tests.*—Ammonia, a white precipitate soluble in excess; ferrocyanide of potassium, a white precipitate; sulphuretted hydrogen, a white precipitate in pure and neutral solutions. Nitrate of baryta will show the presence of sulphuric acid, and nitrate of silver of hydrochloric acid.

**TIN.**—The chlorides of tin are used in dyeing, etc.

*Tests.*—Protochloride gives a dark-brown precipitate with sulphuretted hydrogen; a grey precipitate with bichloride of mercury; a deep purple with chloride of gold. Perchloride gives a yellow precipitate with sulphuretted hydrogen; no precipitate with gold or corrosive sublimate.

*Symptoms.*—Are those of irritant poisoning generally; *treatment* similar.

**SILVER.**—Nitrate of silver is a powerful irritant.

*Tests.*—Black precipitate with sulphuretted hydrogen; white with hydrochloric acid.

*Treatment.*—Common salt.

**IRON.**—Sulphate of iron and perchloride of iron have proved fatal.

*Tests.*—Black precipitate with sulphide of ammonium. Greenish-blue precipitate with ferrocyanide of potassium.

*Treatment.*—Emetics and diluents; magnesia.

**BISMUTH.**—Subnitrate has proved fatal in two-drachm doses. Often contains arsenic.

*Tests.*—Deep-brown precipitate with iodide of potassium.

*Treatment.*—Emetics and emollient drinks.

**CHROME.**—Bichromate of potash, used as a dye, has been fatal more than once. In those engaged in its manufacture, unhealthy ulcers are formed on the nasal septum. These may to some extent be prevented by the workmen taking snuff.



*Tests.*—Yellow precipitate with salts of lead, deep red with those of silver.

*Treatment.*—Emetics, magnesia and diluents.

### XXXI.—NARCOTICS : OPIUM AND MORPHIA.

**OPIUM.**—The inspissated juice of the unripe capsules of the papaver somniferum (N.O. Papaveraceæ). As a poison it is generally taken in the form of the tincture (laudanum). Opium is found in almost all so-called “soothing-syrups” for children, and in Godfrey’s cordial and Dalby’s carminative.

The most important active principles of opium are its alkaloid, morphia, and the acid, meconic acid. The quantity of morphia found in opium varies from two to ten per cent.

*Symptoms.*—Usually commence in about twenty or thirty minutes. Giddiness, drowsiness and stupor, followed by insensibility. Patient seems asleep, may be roused by loud noise, but quickly relapses. Breathing becomes slow and stertorous, pulse weak, countenance livid. As coma increases, pulse becomes slower and fuller. The pupils are as a rule contracted, even to a pin’s point, but they may be sometimes dilated, and are insensible to the action of light. In deep, natural sleep the eyes are turned upwards and the pupils contracted. Bowels confined; skin cold and livid, or bathed in sweat. Nausea and vomiting are sometimes present. Remissions are not unfrequent, the patient appearing about to recover and then relapsing.

The habitual use of opium is not so uncommon as is often supposed, and opium-eaters are able to take enormous quantities of the drug. The habitual opium-eater may be known by his attenuated body,

withered yellow countenance, stooping posture, and glassy, sunken eyes.

*Post-mortem appearances.*—Not very characteristic. Turgescence of cerebral vessels. There may be effusion under arachnoid, into ventricles, at base of the brain and around the cord. Rarely, extravasation of blood. Stomach and intestines usually healthy. Lungs gorged : skin livid.

*Fatal period.*—Three quarters of an hour and upwards ; but in many cases, if life is prolonged for eight hours, recovery takes place.

*Fatal dose.*—Four grains of opium, smallest in an adult ; children are proportionately much more susceptible to the action of opium than adults.

*Treatment.*—Stomach-pump, emetics, strong coffee or tea, ammonia to nostrils, etc. Patient must be kept roused by dashing cold water over him, flagellating with a wet towel, walking about, etc. Treatment must be continued as long as any life remains.

*Method of extraction from the stomach, etc.*—Opium itself cannot be directly detected, but we must test for morphia and meconic acid. These may be separated from organic mixtures thus : boil the organic matter with distilled water, spirit, and acetic acid ; filter, and to the fluid passed through, add acetate of lead till precipitate ceases. Filter. Acetate of morphia passes through, and meconate of lead remains. The solution of acetate of morphia may be freed from excess of lead by hydrogen sulphide and filtered, excess of hydrogen sulphide driven off by heat, and tests applied. Put the meconate of lead with water into a beaker and pass hydrogen sulphide ; sulphide of lead is formed and meconic acid set free. Filter. Concentrate the solution of meconic acid, and allow a portion to crystallize, and apply tests.

*Tests.*—Morphia, or its acetate, gives an orange-red

colour with nitric acid ; decomposes iodic acid, setting free iodine ; with perchloride of iron, gives a rich indigo-blue ; with bichromate of potash, a green turning to brown.

Meconic acid gives a blood-red colour with perchloride of iron, not discharged by corrosive sublimate or chloride of gold. The similar colour produced by sulpho-cyanide of potassium and perchloride of iron is discharged by chloride of gold and corrosive sublimate.

### XXXII.—BELLADONNA, HYOSCYAMUS, STRAMONIUM, AND SOLANUM.

**BELLADONNA.**—The root, leaves, and berries of the *atropa belladonna* (N.O. *Atropaciæ*) are poisonous from the presence of an alkaloid—atropia.

*Symptoms.*—Dryness of mouth and throat, intense thirst, dysphagia and dysphonia, quick pulse, delirium and stupor. Strangury and hæmaturia, and an eruption like that of scarlatina have been noticed. Dilatation of the pupil occurs, whether the poison be taken internally or applied locally to the eye.

*Post-mortem appearances.*—Congestion of cerebral vessels, dilated pupils, red patches in alimentary canal.

*Treatment.*—Purgatives, emetics, charcoal.

*Method of extraction from the stomach, etc.*—Use Stas' process for this and other alkaloids. (Aid vii.)

*Tests.*—Atropia may be recognised by its action on the pupil.

**HYOSCYAMUS.**—(Henbane). All parts of the plant, *H. Niger* (N.O. *Atropaciæ*), are poisonous from the presence of the alkaloid—hyoscyamia.

*Symptoms.*—Giddiness, flushings, excitement, trem-

bling of limbs and loss of power, pupils dilated. Fierce delirium, loss of speech, and exhaustion.

*Post-mortem appearances.*—Cerebral and pulmonary congestion.

*Treatment.*—Emetics and purgatives.

STRAMONIUM.—(Thornapple.) All parts of the datura stramonium are poisonous. The alkaloid is daturia.

*Symptoms.*—Very similar to those of belladonna and hyoscyamus, the *post-mortem appearances* and *treatment* being also analogous.

SOLANUM NIGRUM, Black nightshade; SOLANUM DULCAMARA, Bitter-sweet or woody nightshade; and SOLANUM TUBEROSUM, Potato, possess poisonous properties, which reside chiefly in the berries and leaves. The symptoms are: giddiness, dimness of sight, trembling of the limbs and delirium, with dilated pupils, vomiting and purging.

*Treatment.*—As for belladonna, etc.

### XXXIII.—CAMPHOR.

A concrete vegetable oil, Camphora officinarum (N.O. Lauraceæ). Poisonous in large doses.

*Symptoms.*—Languor, giddiness, dimness of vision, difficulty of breathing and delirium, with hot skin, flushed face and dilated pupil.

*Post-mortem appearances.*—Gastric and intestinal inflammation, injection of the meninges of the brain. Odour of poison throughout body.

*Treatment.*—Emetics and purgatives.

*Tests.*—Dissolves in alcohol, floats and burns on water.

## XXXIV.—COCCULUS INDICUS.

The fruit of *anamirta cocculus* (N.O. *Menispermaceæ*). Contains a poisonous alkaloid, *picrotoxia*, used to adulterate beer, and by poachers to catch fish.

*Symptoms*.—Nausea, vomiting, and abdominal pains, with stupor, and complete loss of voluntary power.

*PICROTOXIA* obtained by Stas' process appears in fine white prismatic crystals, of an intensely bitter taste. Soluble in boiling water, alcohol, and ether. If the crystals are moistened with sulphuric acid and potassium bichromate added, green oxide of chromium is set free.

## XXXV.—ALCOHOL, ETHER, CHLOROFORM, ETC.

Alcohol, ether, and chloroform, all induce narcotism, often preceded by delirious excitement, and followed by nausea and vomiting. When they cause death, it is by inducing a state like apoplexy, or by paralysing the heart.

*ALCOHOL*.—When pure, a colourless volatile liquid (sp. gr. '795), cannot be frozen, very inflammable.

*Symptoms*.—Acute poisoning; confusion, giddiness, headache, passing into stupor and coma. Vomiting may occur and recovery ensue, otherwise collapse sets in. Pupils usually dilated.

Chronic poisoning. Drunkards suffer from indigestion, vomiting and purging, jaundice, albuminuria, diabetes, cirrhosis of liver, degeneration of kidneys, congestion of brain, delirium tremens, insanity, paralysis, etc.

*Post-mortem appearances*.—Deep-red colour of lining membrane of stomach. Sometimes congestion of cere-



bral vessels and meninges. Lungs congested, blood fluid. Rigor mortis persistent.

*Fatal dose.*—Uncertain.

*Fatal period.*—Average about twenty-four hours.

*Treatment.*—Stomach-pump. Cold affusion. Ammonia. Galvanism.

*Method of extraction from the stomach, etc.*—Neutralize the contents of the stomach, if acid, with sodium carbonate; place them in a retort and carefully distil. Collect the distillate, mix with chloride of calcium or anhydrous sulphate of copper, and again distil. Agitate distillate with dry potassium carbonate, and draw off some of the supernatant fluid for testing.

*Tests.*—Smell. Dissolves camphor. With dilute sulphuric acid and bichromate of potash, turns green, and evolves aldehyde. Product of combustion makes lime-water white and turbid.

The following table, condensed from Husband, gives the points of distinction between concussion of brain, alcoholic poisoning, and opium poisoning :

CONCUSSION OF BRAIN.	ALCOHOL.	OPIUM.
1. Marks of violence on head.	1. No marks of violence, unless person has fallen. History will be of use.	1. As alcohol.
2. Stupor, sudden.	2. Excitement precedes sudden stupor.	2. Symptoms slow. Drowsiness, stupor, lethargy.
3. Face pale, cold; pupils sluggish, sometimes dilated.	3. Face flushed; pupils generally dilated.	3. Face pale; pupils contracted.
4. Remission rare. Patient recovers slowly.	4. Partial recovery may occur, followed by death.	4. Remission rare.
5. No odour of alcohol in breath.	5. Odour of alcohol in breath.	5. Odour of opium in breath.



**ETHER.**—When pure, a limpid, colourless liquid (sp. gr. .735.)

*Symptoms.*—When taken liquid, same as alcohol. When inhaled as vapour, causes slow, prolonged, and stertorous breathing; face becomes pale, lips bluish, surface of body cold. Pulse first quickens, then slows. Pupils dilated, eyes glassy and fixed. Muscles become flabby and relaxed. Profound anæsthesia. Then pulse sinks and coma ensues, sensation being entirely suspended. Nausea and vomiting not uncommon.

*Post-mortem appearances.*—Brain and lungs congested. Cavities of heart full of dark, liquid blood. Vessels at upper part of spinal cord congested.

*Treatment.*—Exposure to pure air, cold affusion, artificial respiration, galvanism. In poisoning by the liquid, stomach-pump, etc.

*Method of extraction from the contents of the stomach.*—Same as for alcohol. During distillation pass some of the vapour into concentrated solution of bichromate of potash, nitric and sulphuric acids, and note reaction as for alcohol.

*Tests.*—Vapour burns with smoky flame, depositing carbon. Sparingly soluble in water. With bichromate of potash and sulphuric acid, same as alcohol.

**CHLOROFORM.**—A colourless liquid (sp. gr. 1.497), very volatile, giving off dense vapour. Sweet taste and pleasant odour.

*Symptoms.*—When swallowed, same as alcohol. When inhaled, much the same as ether, but produces insensibility and muscular relaxation more rapidly.

*Post-mortem appearances.*—Cerebral and pulmonary congestion. Heart empty, or right side distended with dark blood.

*Treatment.*—Cold affusion; drawing forward tongue; artificial respiration; galvanism and suspension of the individual with his head downwards.

*Method of extraction from the stomach, etc.*—By distillation at 120° Fahr. The vapour as it passes along a glass tube may be decomposed by heat into chlorine, hydrochloric acid and carbon. The first shown by setting free iodine in iodide of starch, the second by reddening blue litmus paper, and the last by its deposit.

*Tests.*—Taste and colour. High specific gravity. Burns with a green flame. Dissolves camphor, gutta-percha, and caoutchouc.

**CHLORAL HYDRATE.**—Prepared from alcohol and chlorine.

*Symptoms.*—Deep sleep, followed by loss of consciousness. Pulse may become quick, and face flushed. Prolonged use of this drug may produce a peculiar eruption on the skin, first described by Dr. Husband. Supposed to act in the blood by being decomposed into chloroform and a formiate.

*Method of extraction from the stomach, etc.*—By distillation in strongly alkaline solutions, when it may be obtained as chloroform and tested.

**NITRO-BENZOLE.**—(Essence of Mirbane.) A heavy yellow oily liquid, obtained by the action of nitric acid on benzole, and having the odour of the oil of bitter almonds.

*Symptoms.*—Headache, heaviness, and then intoxication, convulsions, dilated pupil, and death.

*Post-mortem appearances.*—Nothing characteristic.

*Method of extraction from the stomach.*—Distillation from the contents of the stomach.

*Tests.*—Odour that of oil of bitter almonds, but does not give a crimson colour with sulphuric acid, as the genuine oil does. Insoluble in a solution of sulphate of soda, in which the true oil is soluble.

*Treatment.*—Stomach-pump, emetics, etc.

## XXXVI.—NUX VOMICA, STRYCHNIA, AND BRUCIA.

NUX VOMICA, as used in medicine, consists of the seeds of the *strychnos nux vomica*. From these seeds strychnia is obtained. The symptoms, post-mortem appearances, and treatment of poisoning by nux vomica are the same as for strychnia.

STRYCHNIA is the alkaloid of nux vomica. It is a deadly poison, and forms an active ingredient in many "vermin-killers." It occurs as a white powder or as a colourless crystal, with a very persistent bitter taste; very insoluble in water; more or less soluble in benzole, ether, and alcohol.

*Symptoms.*—Sense of suffocation, twitchings of muscles, followed by tetanic convulsions and opisthotonos. Mental faculties unaffected, face congested and anxious; eyes staring; lips livid. Much thirst. The symptoms differ from tetanus in the absence of trismus or lockjaw. The period of accession of the symptoms varies with the mode of administration of the poison.

*Post-mortem appearances.*—Heart empty, blood fluid, *rigor mortis* persistent. Hands usually clenched; feet arched and inverted. Congestion of brain, spinal cord, and lungs.

*Treatment.*—Emetics and stomach-pump, followed by tannic acid, iodide of potassium, animal charcoal, nicotine, opium, and conia. Chloroform. Chloral.

*Fatal dose.*—(*Smallest.*)  $\frac{1}{4}$  grain.

*Fatal period.*—(*Shortest.*) Ten minutes.

*Method of extraction from stomach, etc.*—The alkaloid may be separated by the process of Stas.

*Tests.*—Strychnia is *unaffected* by sulphuric acid, but gives a purple-blue colour, changing to crimson and light red, with peroxide of lead, manganese, potassium

bichromate, ferridcyanide of potassium or permanganate of potash. This test is so delicate as to show, it is said, the  $\frac{1}{25000}$  of a grain of the alkaloid. A very minute quantity ( $\frac{1}{5000}$  grain) in solution placed on the skin of a frog, after drying, causes tetanic convulsions.

**BRUCIA.**—This alkaloid, found associated with strychnia, possesses the same properties, though in a less powerful degree. Nitric acid gives a blood-red colour, changed to purple with protochloride of tin.

### XXXVII.—CONIUM, PHYSOSTIGMA, ACONITE.

**CONIUM MACULATUM.**—Hemlock (N.O. Umbelliferae). Contains the poisonous alkaloid conia, which is a volatile oil, with a mousy smell. Insoluble in water; soluble in alcohol, ether, and chloroform.

*Symptoms.*—Dryness of throat, headache, dilated pupil, dysphagia, loss of muscular power, passing into complete paralysis. Delirium, coma, and convulsions occasionally.

*Post-mortem appearances.*—Congested brain and lungs; redness of the stomach.

*Treatment.*—Emetics, castor oil, diffusible stimulants.

*Method of extraction from the stomach, etc.*—Use Stas' process. Aid vii.

*Tests.*—Deepened colour and dense white fumes with nitric acid. Pale red, deepening, with hydrochloric acid.

**PHYSOSTIGMA.**—(Calabar bean). The bean from the *P. venenosum* (N.O. Leguminosae).

*Symptoms.*—Vomiting, giddiness, irregular cardiac action. Eyes bright, pupils contracted.

*Treatment.*—Emetics.

*Method of extraction from the stomach, etc.*—Use Stas' process.

*Test.*—The contraction of the pupil which it causes.

**ACONITE.**—(Monkshood.) *Aconitum napellus* (N.O. Ranunculaceæ). Poisonous property depends on an alkaloid, aconitia.

*Symptoms.*—Numbness and tingling in mouth and throat, giddiness, loss of power, vomiting, seldom purging. Pupils dilated. Pulse small. Death often sudden.

*Post-mortem appearances.*—Venous congestion, engorgement of brain and membranes.

*Treatment.*—Emetics, castor oil, animal charcoal, stimulants. Digitalis should be given as an antidote.

*Fatal dose.*—Of root or tincture, 1 drachm.

*Fatal period.*—Average, less than four hours.

*Method of extraction from the stomach, etc.*—Extraction from contents of stomach by Stas' process.

*Tests.*—Chiefly physiological; tingling and numbness when applied to tongue or inner surface of cheek. Effects on mice, etc. An animal alkaloidal substance, or *ptomaine*, has been found in the body, possessing many of the actions of aconite. The presence of this substance was suggested in the Lamson trial.

### XXXVIII.—TOBACCO, LOBELIA.

**TOBACCO.**—*Nicotiana tabacum* (N.O. Solanaceæ) owes its poisonous properties to its alkaloid, nicotine, a volatile, oily, amber-coloured liquid, with an acrid taste and ethereal odour. Soluble in water, alcohol, ether, and chloroform.

*Symptoms.*—First, quickening and strengthening of the pulse, followed by giddiness, fainting, nausea, and vomiting, with syncope, stupor, stertorous breathing, and insensible pupil. Death has occurred after 17 or 18 pipes at a sitting.

*Post-mortem appearances.*—Not uniform or character-



istic. General relaxed condition of muscles ; engorgement of cerebral and pulmonary vessels. Congestion of gastric mucous membrane.

*Treatment.*—Emetics, stimulants.

*Fatal dose.*—Half a drachm.

*Fatal period.*—(*Shortest.*) 18 minutes.

*Method of extraction from the stomach, etc.*—Nicotine, like conia, is a volatile oily alkaloid. Digest the contents of the stomach in cold distilled water and *very dilute* sulphuric acid, strain, filter, and press residue. Evaporate the filtrate to half its bulk, digest with alcohol, and evaporate alcohol off in a water bath. Dissolve residue—sulphate of nicotina—in water, and make solution alkaline with potash ; then shake with ether in a test-tube. Remove ether and allow it to slowly evaporate. Test resulting alkaloid.

*Tests.*—No change of colour with the mineral acids. White deposit with corrosive sublimate. Sulphuric and bichromate of potash give a green colour—oxide of chromium. Precipitate with bichloride of platinum, and with carbazotic acid.

LOBELIA INFLATA.—Indian tobacco (N.O. Lobiaceæ), much used in America in asthma, and contains an alkaloid—lobelia.

*Symptoms.*—Nausea, vomiting, giddiness, cold sweats, prostration.

*Post-mortem appearances and treatment.*—As tobacco.

*Fatal dose.*—One drachm of powdered leaves.

*Fatal period.*—36 hours.

### XXXIX.—HYDROCYANIC ACID.

PRUSSIC ACID is one of the most formidable poisons. When diluted with water, it forms the ordinary acid of the druggist. The Pharmacopœial acid contains two



per cent, of hydrocyanic acid ; Scheele's four per cent. A colourless liquid, feebly acid, with slight odour of bitter almonds.

*Symptoms.*—Giddiness, insensibility, convulsive breathing, clammy skin, dilated pupils, closed jaws. Muscles relaxed and flaccid. Breathing may be stertorous. Narcotic symptoms occasionally. The symptoms closely resemble those of an epileptic fit.

*Post-mortem appearances.*—Skin livid, pale or violet. Hands clenched, nails blue, jaws fixed, froth about mouth. Eyes prominent and glistening. Odour of acid from body. Venous system gorged.

*Treatment.*—Chlorine and the mixed oxides of iron are antidotes. Cold affusion is the most readily at hand, and *most* useful ; promotion of vomiting, ammonia.

*Fatal dose.*—About 45 minims of the B.P. acid.

*Fatal period.*—From two to five minutes after a large dose.

*Method of extraction from the stomach, etc.*—Having previously carefully fitted a watch-glass to a wide-mouthed bottle, nearly fill the bottle with the contents of the stomach, blood, secretions, etc. Place a few drops of a solution of nitrate of silver on the concave surface of the watch glass, and cover the mouth of the bottle with it. The vapour of hydrocyanic acid, if present, will form a white precipitate which may be tested. Other watch-glasses, treated with sulphide of ammonium or sulphate of iron and liquor potassæ, will give the reactions of the acid with appropriate tests. This method removes all objections as to foreign admixture, etc. If the acid is not at first detected, gentle warming of the bottle in a water bath will assist the evolution of the vapour. The vapour may further be obtained by distillation, but this process is open to objections, to which the other is not.

*Tests.*—With nitrate of silver a white precipitate insoluble in cold, but soluble in boiling nitric acid. The precipitate heated evolves cyanogen, having an odour of peach-blossoms, and burning when lighted with a pink flame. Liquor potassæ and sulphate of iron give a brownish-green precipitate, which turns to Prussian-blue with hydrochloric acid. Liquor potassæ and sulphate of copper give a greenish-white precipitate, becoming white with hydrochloric acid. Bisulphide of ammonia gives sulpho-cyanide of ammonium; this develops a blood-red colour with perchloride of iron, bleached by corrosive sublimate.

## XL.—OXALIC ACID.

OXALIC ACID, or acid of sugar, is often used by suicides, though not often by murderers. It has been mistaken for Epsom Salts, and is also not unlike sulphate of zinc.

*Symptoms.*—*Large doses.*—Sour taste, burning at pit of stomach, pain and tightness in throat. Vomiting of mucus, bloody or dark coffee-ground matters, purging and tenesmus, followed by collapse, feeble pulse, cold skin; also sourness of mouth, swelling of tongue, dysphagia, etc. In some cases cramps and numbness in limbs, pain in head and back, delirium, and convulsions.

*Small doses.*—Narcotic, ending in death by coma.

*Post-mortem appearances.*—Mucous membrane of mouth, throat, and gullet, white and softened as if they had been boiled. Stomach contains dark, grumous matter, and is soft, pale, and brittle. Intestines slightly inflamed. Stomach sometimes quite healthy.

*Treatment.*—Warm water freely; then chalk, car-

bonate of magnesia, etc. Not alkalies, as the oxalates of the alkalies are soluble and poisonous. Emetics, but not stomach-pump.

*Fatal dose.*—(*Smallest.*) Three drachms.

*Fatal period.*—Has been almost instantaneous.

*Method of extraction from the stomach, etc.*—Mince up the coats of the stomach and boil them in water, or boil the contents of the stomach and subject them to dialysis. Concentrate the distilled water outside the tube containing the vomited matters, etc., and apply tests.

*Tests.*—White precipitate with nitrate of silver, soluble in nitric acid and ammonia. When the precipitate is dried and heated on platinum foil, it disperses as white vapour with slight detonation. Sulphate of lime in excess gives a white precipitate; soluble in nitric or hydrochloric acid, insoluble in oxalic, tartaric, acetic, or any vegetable acid.

BINOXALATE OF POTASH (Salt of lemons, or salt of sorrel), occurs in many plants.

*Symptoms, post-mortem appearances, and treatment* as for oxalic acid.

## XLI.—DIGITALIS.

All parts of the plant, *digitalis purpurea*, purple fox-glove (N.O. Scrophulariaceæ), are poisonous, from the presence of an alkaloid—digitalin.

*Symptoms.*—Nausea, vomiting, purging, and abdominal pains. Headache, giddiness, and loss of sight; pupils dilated, insensible; pulse weak, slow, and irregular; cold sweat. Salivation occasionally, or syncope and stupor.

*Post-mortem appearances.*—Congested condition of brain and membranes; inflammation of gastric mucous membrane.

*Treatment.*—Emetics, aperients, infusions containing tannin, as coffee, tea, oak-bark, galls, etc. Stimulants.

*Method of extraction from the stomach, etc.*—Use Stas' process. Aid vii.

*Tests for digitalin.*—A white substance, sparingly soluble in water, not changed by nitric acid; turns yellow, changing to green, with hydrochloric acid; evaporated to dryness, and treated with sulphuric acid, yields a rose colour, turning to mauve with vapour of bromine.

## XLII.—CARBONIC ACID GAS, SULPHURETTED HYDROGEN, CARBURETTED HYDROGEN.

CARBONIC ACID GAS is generated in many ways. During fermentation; in burning lime; in the combustion of fuel, etc.

*Symptoms.*—Acts as irritant when pure; diluted, causes sense of weight in forehead and back of head, giddiness, vomiting, somnolence, loss of power. Insensibility, stertorous breathing, and death from apoplexy or apnœa. Convulsions occasionally.

*Post-mortem appearances.*—Body swollen and livid; countenance bloated, or calm and pale. Limbs rigid, abdomen distended. Right side of heart, lungs, and large veins gorged. Brain and membranes vascular.

*Treatment.*—Pure air, cold affusion, stimulants, artificial respiration, galvanism, inhalation of oxygen.

SULPHURETTED HYDROGEN is characterized by its odour, like that of rotten eggs.

*Symptoms.*—Giddiness, pain and oppression of stomach, nausea, loss of power. Delirium, tetanus, and convulsions.

*Post-mortem appearances.*—Fluid and black blood, loss of contractility of muscles, rapid putrefaction.

*Treatment.*—Fresh air, stimulants, inhalation of chlorine.

*Tests.*—Acetate of lead throws down a brown or black precipitate, according to the quantity of the gas.

**CARBURETTED HYDROGEN (Coal Gas).**—Coal gas contains light carburetted hydrogen or marsh gas, olefiant gas, ammonia, sulphuretted hydrogen, carbonic acid, carbonic oxide, free hydrogen and nitrogen. Coal gas has an offensive odour, burns with a yellowish-white flame, yielding water and carbonic acid.

*Symptoms.*—Foaming at mouth, vomiting, convulsions, tetanic spasms, stertorous breathing, dilated pupil. The breath smells of gas; there is profound stupor; the patient, if alive, exhales gas from the lungs when removed into a fresh room, or into the air.

*Post-mortem appearances.*—Pallor of skin and internal tissues; florid colour of neck, back, and muscles; fluid florid blood; infiltration of lungs.

*Treatment.*—Fresh air, cold affusion, diffusible stimulants.

### XLIII.—VEGETABLE PURGATIVES.

The vegetable purgatives are aloes, colocynth, gamboge, jalap, scammony, seeds of castor oil plant, croton oil, elaterium, the hellebores, and colchicum. All these have, either alone or combined, proved fatal. The active principle in aloes is aloin; of jalap, jalapine; of white hellebore, veratria; and of colchicum, colchicine. Morrison's pills contain aloes and colocynth; aloes is also the chief ingredient in Holloway's pills.

*Symptoms.*—Vomiting, purging, tenesmus, etc., followed by cold sweats, collapse, or convulsions.

*Post-mortem appearances.*—Inflammation of alimen-



tary canal; ulceration, softening, and sub-mucous effusion of dark blood.

*Treatment.*—Diluent, opium, stimulants, abdominal fomentations, etc.

#### XLIV.—ABORTIVES.

The two vegetable substances principally used as abortives are savin and ergot.

**SAVIN.**—(*Juniperus sabina*, N.O. *Coniferae*.) Leaves and tops of the plant yield an acrid oil having poisonous properties. Has produced death when used to procure abortion.

*Symptoms.*—As of irritant poisons (p. 49). Purging not always present.

*Post-mortem appearances.*—Acute inflammation of alimentary canal. Green powder found. This washed and dried, and then rubbed, gives odour of savin.

*Test.*—A watery solution of savin strikes deep green with perchloride of iron, and if an infusion of the twigs has been taken, the twigs may be detected with the microscope. The twigs obtained from the stomach, dried and rubbed between the finger and thumb, will give the odour of savin.

**ERGOT** (*Secale cornutum*).—A parasitic fungus attacking wheat, barley, oats, and rye, which has the power of causing contraction of unstriped muscular fibre and of the uterus.

*Symptoms.*—Lassitude, headache, nausea, diarrhoea. Small quantities frequently repeated produce gangrene of the extremities.

*Tests.*—Lake-red with liq. potassæ; this liquid filtered gives a precipitate of same colour with nitric acid.



## XLV.—IRRITANTS PRODUCING NERVOUS SYMPTOMS.

**WATER HEMLOCK.**—(Cowbane.) Root has been mistaken for parsnip. Produces tetanus, dilated pupil, insensibility, coma, nausea, and diarrhœa. P.-M. shows corrosion and perforation of stomach.

**FOOLS' PARSLEY.**—(*Æthusa cynapium*.) Has been mistaken for parsley, and the roots for young turnips. Produces heat in mouth, nausea, and vomiting; headache, giddiness, stupor, dilated pupil, and lockjaw.

**LABURNUM.**—(*Cytisus laburnum*.) Contains an alkaloid producing vomiting, foaming at mouth, and insensibility.

**YEW.**—Leaves and berries of *Taxus baccata* act as irritant poisons. P.-M. shows irritation of alimentary canal.

## XLVI.—SIMPLE IRRITANTS.

**ARUM.**—(Cuckoo-pint; lords and ladies.) All parts are acrid and irritating.

**MEZEREON.**—(*Daphne mezereum*.) Bright red berries, taken by children for currants.

**RANUNCULUS.**—(Buttercup; crowfoot.) Every part of the fresh plant contains an acrid principle. The juice is a powerful vesicant.

**BRYONY.**—Two plants included under this head, *B. dioica*, N.O. Cucurbitaceæ, and *Tamus communis*, N.O. Dioscoreaceæ. Both possess irritant properties, and, growing wild, may be eaten by children.

*The symptoms, post-mortem appearances, and treatment of the above are the same as for irritant poisons generally.*

## XLVII.—MISCELLANEOUS.

**CARBOLIC ACID.**—This substance has not unfrequently been taken by mistake, with fatal results.

*Symptoms.*—Skin pale and cold, pupils semi-dilated; muscular twitchings; distension of abdomen; pulse small and very rapid; death by coma; urine dark green.

*Treatment.*—Stomach-pump, liq. calcis, olive oil or mixture of olive oil and castor oil.

*Method of extraction from the stomach.*—Wash the contents of the stomach with ether, decant the ether and allow it to evaporate, when the odour of carbolic acid will be readily detected.

*Tests.*—The odour is the most delicate test for this substance. The pure acid gives a beautiful purple colour with a solution of perchloride of iron.

**CANTHARIDES.**—The insect known as *Cantharis vesicatoria*, or Spanish fly, contains a strong irritant poison which acts on the urinary and generative organs.

*Symptoms.*—Acrid taste, tightness in throat, burning in pit of stomach, dysphagia, bloody stools, and vomiting; priapism, strangury, convulsions and delirium.

*Post-mortem appearances.*—Those of great irritation. Portions of wings and wing-cases may be found in stomach and recognised by microscope.

*Treatment.*—Emetics, warm liquids, castor oil. Diluents and opium.

*Fatal dose.*—One ounce of tincture.

*Fatal period.*—24 to 36 hours.

*Method of extraction from the stomach, etc.*—See Stas' process. Aid vii.

*Tests.*—Sulphuric or nitric acid produces no change of colour in cantharidine. A small portion of the extract obtained from the stomach may be applied

to the lips, and the absence or presence of vesication noted.

**PUTRID ANIMAL MATTER.**—May produce symptoms of irritant poisoning, especially in the form of sausages, bacon, ham, cheese, and goose-grease.

*Symptoms.*—Come on after three or four hours, and are those of irritation in the alimentary canal, with occasionally collapse, or narcotic symptoms.

*Treatment.*—Remove poison, and treat symptoms.

FINIS.

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